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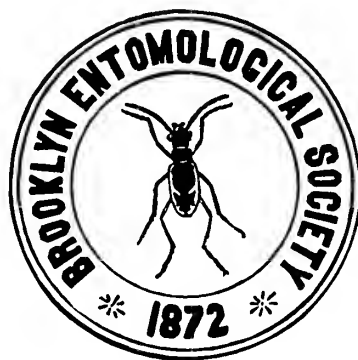
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BULLETIN

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No. 1

THREE NEW CICINDELIDAE FROM SOUTH TEXAS WITH COLLECTING NOTES ON OTHER CICINDELIDAE (COLEOPTERA)¹

By GEORGE B. VOGT, University of Maryland,
College Park, Maryland.

The following report deals with the Cicindelidae collected by the writer during 1946 and 1947 in the Lower Rio Grande Valley and vicinity, Texas. For liberal advice and encouragement in the preparation of this paper the writer is especially indebted to Dr. M. A. Cazier of the American Museum. The writer also extends his heartfelt thanks to the authorities at the U. S. National Museum who have been most cooperative in making available for study the collections of that institution which in addition to being almost completely representative of the described forms of the United States and Mexico are rich in material determined by Walther Horn.

In interpreting the records that follow, some idea of the extent and frequency of the collecting may be desirable.² The shores of the Rio Grande southwest of Mission were visited on the following dates during 1946: January 20 and 26, March 10, May 18, June 23, July 6 and 14, August 2, and December 1. Collecting at Boca Chica along the coast of the Gulf of Mexico was limited to three

¹ Scientific Article No. A223, Contribution No. 2146 of the Maryland Agricultural Experiment Station (Department of Entomology).

² For further details on the collecting localities see "A Biologically Annotated List of the Buprestidae of the Lower Rio Grande Valley, Texas" (In press) *Annals of the Entomological Society of America*.

visits on July 7 and 13 and October 19, 1946. The mesquite and hackberry forests along the Rio Grande flood plain southwest of Mission were visited almost weekly during 1946. In 1947 collecting was devoted largely to the brush in the uplands of Starr County, with a trip being made almost every week end. The lights about Pharr were visited at least twice weekly during 1946 and 1947.

In general, the frequency of the resulting collections indicates that the riparial and Gulf coastal forms have a wide seasonal distribution with significant populations existing during the summer and fall. The dry land forms seem to appear only during the fall and winter, with the exception of *Cicindela lemniscata* Lec. which may not be altogether a dry land form. The occurrence of the *Megacephala* arouses no comment.

***Megacephala* (Tetracha) *affinis angustata* Chevr.**

Not uncommon on ground about lights in Pharr especially during May and June and then again in September.

***Megacephala* (Tetracha) *carolina* Linn.**

One specimen at light in Pharr, October 2, 1946.

***Cicindela scutellaris unicolor* Dej.**

On November 30, 1946 this sub-species was found in small numbers in the extensive sandy meadowlands between the ranges of sand hills five miles east of San Perlita, Willacy County. These beetles were usually seen on the sand piles at the entrances of pocket gopher holes. Again on January 25, 1947 when a second trip was made to the sand hill region this sub-species was found occasionally under similar circumstances thirty miles north of Raymondsville.

***Cicindela nigrocoerulea* subsp. *subtropica* subsp. nov.**

Smaller but of same form as *C. nigrocoerulea* Lec. varying from immaculate to maculate.

Female. Head across the eyes wider than pronotum; bare except for two ocular setae, coarsely striate, impunctate; clypeus and genae bare; labrum wide, hardly produced medially, with three uniform small-sized teeth, and white narrowly margined with black; palpi piceous, maxillary sparsely hairy, second segment of labial densely hairy and pale-colored; mandibles tridentate, shining black with white base; antennae bluish piceous, first, third, and fourth

segments with a few prominent terminal setae, the latter two with median setae.

Pronotum black, sericeous, bare, except for sparse closely appressed hairs at the sides, little wider than long; side margins rounded and slightly narrowed at base, widest at apical fourth; apical and basal transverse impressions deep, median longitudinal impression indicated, with transverse grooves extending therefrom; surface granulate.

Elytra black sericeous, very sparsely, obsoletely punctate; surface finely granulate, sericeous with a row of shallow foveolae along the suture and a few along the humeral impression; sides gradually widening to middle, then subparallel to apical third, then evenly rounded to apex; apical margins not serrulate; markings consist of minute humeral and posthumeral dots, a middle band indicated by anterior and posterior spots, and a narrow apical lunule.

Beneath black with faint bluish reflections; sides sparsely covered with rather short white hairs which are recumbent except for the erect hairs on the sides of the prothorax; surface minutely granulate; legs with tibiae greenish black and tarsi violaceous; anterior coxae covered with long white pile, femora and tibiae sparsely clothed with short suberect white hair. Length 10.9 mm., width 4.6 mm.

Male. Somewhat smaller than female. Length 9.7 mm., width 4.0 mm.

Type material. Described from 14 females and 8 males: one collected at Mercedes, Texas and 21 collected in S. W. Hidalgo Co., Texas, five from $2\frac{1}{2}$ miles southeast and sixteen from five miles southwest of Mission; September 29 through October 27, 1946. At the second locality this species occurred in open places and along little used roadways through second growth mesquite and huisache growing in the government maintained floodway. At the last locality the species was found along lonely roadways, and in clearings in the mesquite forestland. Type material deposited as follows: type and two paratypes in the United States National Museum (No. 59,055), three paratypes in the American Museum, and allotype and remaining paratypes in the collection of the writer.

Variations. There is considerable variation in the material studied. In the females two specimens are immaculate except for a vestige of the apical lunule. In the other female specimens the markings of the type are represented, varying from bare vestiges of the markings to rather heavy maculations. The series of male specimens show the same variations with the heaviest maculate form having

vestiges of a marginal line which is absent in the other specimens. The sericeous black upper surface of a few specimens has faint greenish reflections. The under surface and legs vary from shining black with some bluish reflection to purplish or mostly blue with green and rosaceous tinges. The ratio of the width across elytra to the width of pronotum varies from 1.59 to 1.71. In the males this ratio ranges from 1.62 to 1.77. Length: 9.8–12.1 mm., width: 4.0–4.8 mm.

Comparison. This sub-species is very close to *nigrococrulea* Lec. and may easily be confused with the black forms of that species which are represented in the U. S. National Museum by specimens from Flagstaff, Arizona and Koehler, New Mexico. Owing to its variability the writer has not been able to base this sub-species on any single character. But aside from its different geographical occurrence, it differs physically one way or another from *nigrococrulea* Lec. in being somewhat smaller, black in color with a significantly greater tendency to be maculate, and the apical region of the elytra is somewhat more convex. Surface sculpture among the two are essentially the same including the sericeous appearance.

From *atterima* Klug with which this new sub-species bears some relationship and similarity in appearance, separation may be readily made on the irregular vermiculate pattern taken by the sericeous sheen of the former species. Also the apical areas of the elytra of this *Cicindela* are much flatter.

***Cicindela obsoleta* subsp. *neojuvenilis* subsp. nov.**

Similar in appearance to *C. obsoleta anita* Dow but considerably smaller.

Male. Head across the eyes slightly wider than pronotum, bare except for two ocular setae, granulate, impunctate, and with striae vaguely indicated; clypeus and genae bare; labrum wide somewhat produced medially, armed with three rather uniform distinct teeth, and white, margined with black; palpi purplish black, maxillary with a few hairs, second segment of labial densely hairy and white; mandibles tridentate, piceous, with base white; antennae dark purplish green with a few hairs on segments one, three and four.

Pronotum dull black with faint greenish and purplish reflections in the impressions, bare except for sparse closely appressed hairs at the sides, wider than long; side margins rounded, widest at about apical third; basal and apical transverse impressions prominent; median longitudinal impression evident with faint transverse grooves extending therefrom; surface finely granulate.

Elytra dull black; surface finely granulate with very sparse obsolete punctures just behind scutellum; humeral impression with a few setigerous punctures and sub-sutural row of foveolae represented by only six setigerous punctures at basal fourth; sides sub-parallel to apical fourth then evenly rounded to apex, apical margins not serrulate; markings are prominent, consisting of humeral and post humeral dots, middle band and apical lunule; middle band does not attain margin, is obliquely bent with the middle portion greatly narrowed to a bare connection between.

Beneath greenish to bluish black, sparsely hairy with erect to sub-erect white hairs; legs green, sparsely clothed with sub-erect rather coarse hairs; front femora and coxae somewhat more densely hairy, trochanters bare except for single permanent setae. Length 14.0 mm., width 5.1 mm.

Female. Somewhat more narrow than male and with post humeral spot barely indicated, middle band more reduced, and apical lunule reduced to just two small spots. Length 15.8 mm., width 6.0 mm.

Type material. Described from five male and six female specimens collected in S. W. Hidalgo County, Texas; five miles southwest of Mission; October 6 through December 1, 1946. This species was associated with the mesquite forestland along the alluvial flood plain of the Rio Grande, occurring along lonely roadways, edges of cultivated fields and in clearings. It was not a common insect and seemed to be a fall and winter species, a large specimen being seen on the wing as late as January 16, 1947. Type material deposited as follows: type and paratype in the U. S. National Museum, (No. 59,056) two paratypes in the American Museum, and allotype and remaining paratypes in the writer's collection.

Variations. On two males the markings are somewhat reduced as compared with those of the type. On two females the post humeral spot is lacking and one of these has all markings barely indicated. Another female lacks all markings except a small portion of the apical lunule. Length 13.4–15.8 mm., width 5.1–6.0 mm.

Comparison. On the basis of its geographical occurrence, coloration, and facies the affinities of this species seem to be with the Mexican *C. obsoleta juvenilis* W. H. from which it may be distinguished by its slightly broader form, impunctate elytra, broader labrum, less distinct labral teeth and by its markings which do not approach those of the Mexico *C. luteolineata* Chev. as do those of *juvenilis*. From *C. obsoleta auita* Dow *ucojuvenilis* may be separated by its smaller size, smooth elytra and the greater metallic luster of its legs and under surface.

***Cicindela punctulata punctulata* Oliv.**

A typical specimen was collected at light in Pharr, August 17, 1947.

***Cicindela tenuisignata* Lec.**

During June, July and August rather abundant $5\frac{1}{2}$ miles southwest of Mission on fine sand and silt beaches along the Rio Grande.

***Cicindela severa severa* Laf.**

On July 7 and 13, 1946 found sparingly along the broad mucky shores of a large drying salt-water lagoon behind the beach at Boca Chica (Just one mile north of the mouth of the Rio Grande).

***Cicindela lemniscata* Lec.**

Four specimens were collected at lights May 24 and September 20, 1947 in Rio Grande City. This species was occasionally seen during September and early October, 1947 in the dry uplands north of Rio Grande City.

***Cicindela cazieri* sp. nov.**

Somewhat smaller but of same form as *C. politula* Lec. Elytral maculations similar to those of *C. rufiventris* Dej.

Male. Head with eyes wider than pronotum, bare except for two ocular setae, rugose, granulose, impunctate; clypeus and genae bare; labrum wide, irregularly rounded, with an inconspicuous central tooth, ivory colored, with very narrow black margins; maxillary palpi shining green, sparsely hairy; second segment labial palpi densely hairy and white; mandibles tridentate, cupreous black with white base; four basal segments of antenna green with a few hairs on segments one, three, and four.

Pronotum coppery black, bare except for sparse but conspicuous closely appressed white hairs at the sides, little wider than long with sides rounded and slightly narrowed at base, widest at apical fourth, with apical and basal transverse impressions moderately deep and green to blue; median longitudinal impression barely indicated with fine transverse grooves extending therefrom; surface granulate.

Elytra coppery black but less metallic than pronotum, more or less sparsely and shallowly punctate, the punctures coppery to green; surface finely granulate hardly shining with a row of shallow foveolae along the suture and a few along the groove defining the umbone, these foveolae made distinct by their bright green and

cupreous color; sides sub-parallel to apical fourth, then rounded to apex; apical margins finely serrulate. Markings consist of a prominent apical lunule and a median lunule indicated by two prominent elongate spots.

Beneath green with coppery and rosaceous tinges with abdomen colored as in *C. politula*; sides moderately covered by long appressed coarse hairs; legs coppery green covered with sparse sub-erect white hairs; anterior coxae covered with long white hair. Length 10.1 mm., width 3.6 mm.

Female. Same as male except for slightly larger size. Length 11.0 mm., width 4.2 mm.

Type material. Described from three male and four female specimens collected in Starr County, Texas, ten miles north of Rio Grande City, along the edges and along dirt sideroads of the highway leading to Roberson; October 1 and 3, 1947. The beetles were numerous, but were very difficult to collect, being the most wary species that the writer has ever encountered. They were associated with *C. schauppi* Horn which was abundant and easy to collect. Type and one paratype in the U. S. National Museum collection (No. 59,057), two paratypes in the collection of the American Museum, and allotype and two paratypes in the collection of the writer.

Variations. In addition to the markings of the types, two males bear a distinct supplementary spot and a single well-marked female has this spot developed along with the post humeral spot. In another female the post humeral spot is vaguely indicated. Length 9.4–12.0 mm., width 3.5–4.5 mm.

Comparison. On the basis of its vestiture and markings, the writer considered this *Cicindela* to be a sub-species of *C. rufiventris* Dej. Then, its labrum, elytral outline, and geographic occurrence seemed to indicate stronger affinities with *C. politula* Lec. from which it could be distinguished readily on the basis of its more abundant markings, more prominent vestiture and elytral foveolae, and by its less shining (due to granulation), less conspicuously punctate elytral surface. But, as Dr. Cazier has pointed out to the writer, these differences are of sufficient magnitude to warrant consideration of the material as being of a distinct species.

In recognition of his capable and wholehearted assistance in the preparation of this paper, the writer takes pleasure in dedicating this species to Dr. Cazier.

***Cicindela flavopunctata rectilatera* Chaud.**

Abundant on fine sand and silt banks along the Rio Grande

southwest of Mission, May 12 through September. A few specimens were seen on the wing as late as December 1, 1946. Also collected occasionally at lights in Pharr during June and July and a solitary specimen was taken ten miles northeast of Rio Grande City October 5, 1946. No others were seen away from the shores of the Rio Grande River.

***Cicindela schauppi* Horn.**

Abundant locally from mid-September through October in the dry uplands north of Rio Grande City and twelve miles west of Mission (Sam Fordyce). Several specimens were at light at the latter locality on September 20, 1947. Wherever limestone outcroppings occurred in this region, this beetle usually could be found. This species was also collected sparingly at Mercedes and $5\frac{1}{2}$ miles southwest of Mission along lonely roads through the mesquite and huisache forestland.

***Cicindela circumpicta circumpicta* Laf.**

Frequent on the broad mucky shore of the saltwater lagoon at Boca Chica. July 7 through October 19, 1946.

***Cicindela trifasciata tortuosa* Lec.**

Two specimens were collected on October 19, 1946 along the mucky shores of the saltwater lagoon at Boca Chica. Another was taken at light in Pharr early in October.

***Cicindela dorsalis saulcyi* Guer.**

Common along the surf washed beach of the Gulf of Mexico at Boca Chica July 7 through October 19, 1946.

***Cicindela pamphila* Lec.**

Abundant about drying salt pools and along the shore of the saltwater lagoon at Boca Chica July 7 through October 19, 1946.

***Cicindela hamata lacerata* Chd.**

A single specimen was collected along the shores of the saltwater lagoon at Boca Chica July 13, 1946.

***Cicindela sperata sperata* Lec.**

The most abundant tiger beetle along the sand and silt beaches of the Rio Grande southwest of Mission May 18 through October 13, 1946.

***Cicindela togata togata* Laf.**

Abundant about salt flats, drying salt pools and the shores of the saltwater lagoon at Boca Chica July 7 through October 19, 1946. Just two miles south of Mission on an inland "salted out" area this species was in abundance on April 5, 1946.

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**RECORDS OF BEES FROM THE SOLOMON ISLANDS
WITH DESCRIPTIONS OF NEW SUBSPECIES
(HYMENOPTERA, APOIDEA)**

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Preliminary reports and descriptions of the bees of the Solomon Islands have been published by T. D. A. Cockerell, F. F. Kohl and E. Strand*. The present brief contribution is the result of working over a short series of bees in the U. S. National Museum collected during the recent war by G. E. Bohart, J. P. Burks, L. A. Conwell, W. G. Downs, J. G. Franclemont, A. B. Gurney and J. H. Paullus. It is now possible to give new island records for many of the species. The opportunity is also taken to describe two new island subspecies and the hitherto unknown male of *Nomada psilocera*. Identification of some of the species has been facilitated by reference to cotypes and specimens determined by Cockerell in the U. S. National Museum.

***Nomia froggati* Cockerell, 1911**

3 ♂♂; lower Florida Island; March 1945; (G. E. Bohart).

It has been recorded previously from Ruavutu, Guadalcanal and Hagalu, Nggela (Florida Island) by Cockerell (1926, 1936, 1939). Normally the males have orange-yellow bands at the apices of the first five tergites, but occasionally those on the first, fourth and fifth may be completely decolorized, and in one specimen are of a yellowish-green rather than orange.

*Cockerell, T. D. A., 1911. Proc. Linn. Soc. N. S. W. 36: 160-178.

———, 1926. Pan-Pac. Ent. 3: 82, 90.

———, 1929. Records Austral. Mus. 17: 228, 231, 232, 234.

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Kohl, F. F., 1908. Denkschr. Akad. Wiss. Wien 81: 308, pl. 3, fig. 16.

Strand, E., 1911. Wien. Ent. Ztg. 30: 79.

Halictus species

1 ♂; Bougainville; April 10, 1944; (W. G. Downs).

I am unable to place this specimen due to lack of material. This is a stocky specimen for a male which eliminates the introduced *dampieri* Ckll. as a possibility. The sculpture of the mesoseutum and dorsal surface of the propodeum eliminates respectively *viridiscitus* Ckll. and *froggatti* Ckll. from consideration. I would be inclined to place it as the male of *exterus* Ckll., of which I have a female determined by Cockerell, except that his brief notes (1939) on the supposed male of that species indicate a rather slender species. *H. subexterus* Ckll. and *lavoroensis* Ckll., both known only from females, are the other possibilities, unless this male represents an undescribed species. No *Halictus* has been recorded previously from Bougainville.

Lithurgus fortis Cockerell, 1929

7 ♀♀; Bougainville; March 26-29, 1944; (A. B. Gurney). 1 ♀; same data, but April 10, 1944; (W. G. Downs).

The species is known also from Lavoro Plantation and Kaukau on Guadalcanal, Banoni on Bougainville and Kiva Kiva on San Cristobal.

The specimens collected by Gurney were tunneling in the soft wood of a sapling used as a tent support. A bombyliid fly, *Anthrax* sp. (det. C. T. Greene), was taken hovering about the entrances to the tunnels.

Lithurgus fortis nigerrimus, new subspecies

This is the only bee I have from New Georgia, an island on which there seems to be a strong tendency toward the development of discrete subspecies. The present form is structurally identical with typical *fortis*, but lacks the red hair on front, vertex, temples and thorax. There are a few dark red hairs at apex of clypeus. The narrow apical bands on the tergites are dark in *nigerrimus*, pale in *fortis*, and the wings are very strongly infumated in the former, feebly so in the latter. The unique female type of *nigerrimus* is 13.0 mm. long.

Type: ♀; Munda, New Georgia; 1944; (L. A. Conwell) [U. S. National Museum, Type No. 59,042]

Megachile lachesis Smith, 1860

1 ♀; Tenaru, Guadalcanal; 1944; (G. E. Bohart). 3 ♀♀; lower

Florida Island; March 1945; (G. E. Bohart). 2 ♀♀; Bougainville; July 17–September 1944; (A. B. Gurney).

It has been recorded previously from Tulagi Island, Suva on Malaita and Suva on Bougainville.

***Megachile mendanae* Cockerell, 1911**

2 ♀♀; lower Florida Island; March 1945; (G. E. Bohart).

The only definite locality record previous to this is Guadalcanal. Cockerell (1939) described the supposed male from Huugku, Bougainville—females have not been collected there as yet.

***Megachile bougainvilliana* Strand, 1911**

Megachile bougainvilliana Strand, 1911 (March 20th). Wien. Ent. Ztg. 30: 79; [♀; Numa Numa, Bougainville; type in Berlin Mus.].

Megachile ferricincta Cockerell, 1939. Occas. Papers B. P. Bishop Mus. 15: 136; [♀; Guadalcanal; type in Bishop Museum, Honolulu]. NEW SYNONYMY.

Although I have not seen the types, I think there can be no question as to the correctness of the synonymy proposed above. Both authors mention the striking ferruginous bands on the abdomen and the bituberculate apical margin of the clypeus. Cockerell's *bougainvillei* (May 31, 1911, p. 171), named for the explorer not the island, may well be the male.

9 ♀♀; lower Florida Island; March 1945; (G. E. Bohart).

***Megachile shortlandi aurantiscopa*, new subspecies**

Cockerell (1911) described *shortlandi*, naming it for the explorer not the island, from the Solomon Islands, and later (1936) recorded it from Guadalcanal. The *scopa* in typical *shortlandi* is said to be pale fulvous on the second sternite, bright red on the third and fourth, black on sides, and black on the fifth and sixth. A female from Lunga, Guadalcanal determined as *shortlandi* by Cockerell has the *scopa* as above except that the red is somewhat faded. The atypical subspecies *aurantiscopa* agrees in structural details with the specimen determined by Cockerell, but has the entire *scopa* bright orange except for the pale fulvous on the second sternite. The unique female type of *aurantiscopa* is 13.3 mm. long.

Type: ♀; Treasury Island; July 30, 1944; (J. H. Paullus). [U. S. National Museum, Type No. 59,043].

***Coelioxys dispersa* Cockerell, 1911**

1 ♂; Tenaru River, Guadalcanal; 1944; (G. E. Bohart).

It was described originally from the Solomon Islands and Cockerell later (1936) recorded it from Lunga, Guadalcanal.

***Nomada psilocera* Kohl, 1908**

Thus far the species has been known only from the unique female type from Bougainville. A single male from lower Florida Island, March 1945, (G. E. Bohart) before me may be described as follows.

Length 7.2 mm., forewing 4.6 mm. Black, with extensive ferruginous markings as follows: Mandible, labrum, clypeus, front below antennae, narrow lines along inner and posterior eye margins, scape beneath, flagellum entirely, side of pronotum, mesonotum except for a broad central band and a pair of shorter, narrower ones along parapsidal furrows, edges of scutellum, post-scutellum, upper two-thirds of mesopleuron, legs, apices of first to fifth tergites, sixth and seventh tergites and all sternites; second and sixth tergites with a small lateral creamy spot; scutellum except edges and narrow band on outer surface of fore tibia, yellow.

Mandibles not toothed within near apex, flagellar segments unmodified, slightly longer than broad, the flagellum gradually widening toward last segment but hardly clavate, the comparative lengths of first three flagellar segments about 3:2:2; punctation apparently very similar to female, that is, head and thorax coarsely and closely so except mesoscutum and scutellum where it is much sparser, abdomen with very minute sparse ones, the triangular area of propodeum wrinkled; fore coxa not spined at apex; pygidium with apex narrowly notched in middle.

***Anthophora sapiens* Cockerell, 1911**

2 ♀♀; Tenaru, Guadalcanal; October 14, 1943; (J. G. Franclemont). 1 ♂; same data, but 1944; (G. E. Bohart). 1 ♂; lower Florida Island; March 1945; (G. E. Bohart). 2 ♂♂; Treasury Island; July 30, 1944; (J. H. Paullus).

The present species is extremely close in general appearance to what Cockerell identified as *vigilans* Smith from New Guinea. The two species are quite easily distinguished by characters of the last sternites and genitalia of the males. The seventh sternite of *sapiens* has a Y-shaped area of close-set, heavy thorns in the middle on the apical third, the stem of the Y toward the apex of the segment. This sternite in *vigilans* has a very broad, rounded area of much finer thorns. The incurved apex of the gonoforceps in *sapiens* is setose beneath on the apical half only, but entirely setose in *vigilans*. I have found no variation in these characters in the few specimens examined.

Externally the two species are separated only by minute differences in maculations and pattern of the pubescence. In females of *sapiens* the stem and arms of the inverted T on the clypeus are narrower, the supraclypeal mark about half the basal width of clypeus, the scape is dark beneath, the apical bands of pubescence on the tergites are narrower, that of the second being only one-fourth the length of exposed part of tergite, and the apical fringes of the third and fourth sternites are fuscous except for some yellowish at sides; in *vigilans* females the stem and arms of the T are broader, the supraclypeal mark almost as wide as basal width of clypeus, scape with a yellow mark beneath, the apical bands of pubescence on tergites are broader, that of the second being at least one-third the length of exposed part of tergite, and the apical fringes of third and fourth sternites light brown in middle, yellowish on sides. The males of the two are separated by the same differences as the females with regard to the relative width of bands on the tergites, and the color of the apical fringes of the third and fourth sternites.

Cockerell described *sapiens* from the Solomon Islands and recorded it later (1929, 1939) from Lavoro Plantation, Guadalcanal.

***Thyreus gemmatus* (Cockerell), new combination**

Crocisa gemmata Cockerell, 1911. Proc. Linn. Soc. N. S. W. 36: 166; [♀, ♂; Solomon Islands].

1 ♂; Tenaru, Guadalcanal; October 25, 1943 (J. G. Franclemont). 3 ♂♂; same data, but 1944; (G. E. Bohart). 2 ♀♀; Solomons; (J. P. Burks). 1 ♀; lower Florida Island; March 1945; (G. E. Bohart).

Described originally from the Solomon Islands, and recorded later by Cockerell (1926, 1929, 1936, 1939) from Tulagi Island, Lunga and Lavoro Plantation on Guadalcanal, and Buoi, Buka Passage and Suvai on Bougainville. The present species is close to what I identify as *quartinae* (Gribodo) from New Guinea, but is distinguished by the widely separated spots on the first abdominal tergite and differences in the male genitalia.

***Trigona sapiens* Cockerell, 1911**

1 ♀; lower Florida Island; March 1945; (G. E. Bohart).

It was described originally from Solomon Islands and recorded later (1929, 1936, 1939) by Cockerell from New Georgia, Halaita on Nggela (Florida Island) and Lavoro Plantation on Guadalcanal.

NEW OR INSUFFICIENTLY-KNOWN CRANE-FLIES
FROM THE NEARCTIC REGION (DIPTERA,
TIPULIDAE). PART IX¹

By CHARLES P. ALEXANDER, Amherst, Massachusetts.

The preceding part under this general title was published in 1947 (*Bull. Brooklyn Ent. Soc.*, 42: 131-135). At this time I am describing three further species from Arizona and California.

***Tipula (Bellardina) praelauta* n. sp.**

Mesonotum yellow or brownish yellow, paling to light gray on sides, the disk with four conspicuous darker gray stripes that are narrowly margined with dark brown; mediotergite light gray with a brown line on either side of the midstripe; femora and tibiae light brown, the tips narrowly darker; wings medium brown, conspicuously striped longitudinally with whitish subhyaline, including a streak occupying most of cell *R* and continued to the wing-tip in cell *R*₅; abdominal tergites reddish brown, trivittate with dark brown; male hypopygium with the ninth tergite separate from the combined basistyle and ninth sternite; ninth tergite trilobed, the lateral lobes broader, median lobe depressed-flattened, its apex weakly notched; outer dististyle an irregular pale blade, at apex split into a long black spine and a somewhat broader pale blade; inner style a larger flattened pale blade, at its base with a slender taillike lobe; ninth sternite produced caudad into a conspicuous appendage that is split into two halves.

Male. Length about 20-22 mm.; wing 21-23 mm.; antenna about 3.8-4 mm.

Female. Length about 25-26 mm.; wing 22 mm.

Frontal prolongation of head brownish yellow; nasus elongate; palpi dark brown. Antennae with the scape and pedicel yellow; flagellar segments weakly bicolored, the small basal enlargement brown, the stem more yellowed, the outer segments more uniformly darkened; scape elongate, fully equal in length to the first three flagellar segments combined; verticils long and conspicuous. Head above light gray, on orbits passing into brown; vertical tubercle low and inconspicuous.

Pronotum buffy, with a dark brown median stripe. Mesonotal praescutum with the ground obscure yellow or brownish yellow.

¹ Contribution from the Department of Entomology, University of Massachusetts.

paling to light gray on sides; four conspicuous darker gray stripes that are narrowly margined with dark brown, least so on outer margins of the intermediate stripes, more heavily so on the inner edges; scutal lobes pale brown with gray centers; scutellum pale brown, parascutella dark; mediotergite light gray, with a conspicuous brown line on either side of the broader midline, not reaching the posterior border; pleurotergite brownish gray, the katapleurotergite more silvery gray. Pleura brownish gray, with a relatively inconspicuous dorsal brown stripe that is narrowed behind; dorso-pleural membrane buffy. Halteres long, stem brown, brighter at base, knob dark brown. Legs with the coxae gray; trochanters more yellowed; femora and tibiae light brown, the tips narrowly darker; tarsi dark brown, even darker outwardly; spur-formula apparently 1-1-1; claws (male) toothed. Wings medium brown, conspicuously striped longitudinally with whitish subhyaline, including a streak occupying most of cell *R* and continued to wing tip in cell *R*₅; a somewhat comparable pale line along vein *1st A*; costal border and a seam along vein *Cu* somewhat darker brown than the remainder of ground; stigma brown; pale marginal spots in ends of cells *2nd M*₂, *M*₃ and *M*₄; veins brown, anterior cord more yellowed. Squama with numerous trichia; outer medial veins glabrous, *R*₄₊₅ and *Cu* with numerous trichia. Venation: *Rs* about one-half longer than *R*₂₊₃; *R*₁₊₂ entire; *R*₃ virtually straight, *R*₄₊₅ arcuate at near midlength; inner end of cell *1st M*₂ lying proximad of cells *R*₃ and *R*₅; *M*₃₊₄ subequal in length to basal section of *M*₄; cell *2nd A* broad.

Abdominal tergites reddish brown, trivittate with dark brown, the broader median stripe almost continuous, the laterals broadly interrupted on the posterior portions of the segments; subterminal segments more uniformly darkened; sternites uniformly reddish brown; hypopygium brownish yellow. Ovipositor with cerci long and slender, nearly straight to very gently upcurved. Male hypopygium with the ninth tergite separated from the region of the combined basistyle and ninth sternite by membrane; no evident pleural suture. Ninth tergite with the caudal margin trilobed, the lateral lobes broader, entire, with long conspicuous setae; median lobe depressed-flattened, its apex weakly notched, the surface with a row of inwardly-directed setae on either side of the midline. Outer dististyle an irregular pale blade, at apex split into a long black spine and a somewhat broader pale blade, these lying parallel to one another. Inner dististyle a larger flattened pale blade, the outer margin of distal half with numerous small scattered setae;

at base of blade with a slender tail-like lobe. Ninth sternite produced caudad into a conspicuous appendage that is split into two halves. What appears to represent the aedeagus is an erect slender scooplike or pronglike structure arising from the ventral portion of the ninth sternite near the base of its appendage.

Habitat: Arizona. *Holotype:* ♂, Todd's Lodge, Oak Creek Canyon, altitude 5200 feet, October 2, 1948 (*John & Grace Sperry*). *Allotopotype*, ♀, and *paratopotypes*, ♂♀, September 1947, October 5, 1948.

This outstanding fly is another discovery made by the Sperrys, to whom I express my continued indebtedness for very many Tipulidae from our Far West. The longitudinally striped wings give the fly an appearance that is quite different from that of all other members of the subgenus *Bellardina* Edwards, where the wings are marbled and mottled in various patterns in the different species. I can see no reason to question the subgeneric assignment.

***Tipula (Lunatipula) inusitata* n. sp.**

Allied to *usitata*; general coloration of mesonotum light gray, the praescutum with five reddish brown stripes, the three central ones narrow; antennae with scape and pedicel yellow, flagellum black; wings with a weak brownish tinge, very restrictedly patterned; abdomen obscure yellow, trivittate with light brown, the lateral stripes broken, heaviest at the anterior end of segment; male hypopygium with the beak of the inner dististyle narrow, not cut off from body of style by a notch; outer basal lobe low and obtuse; phallosome with the unpaired element forking at apex into two subequal spinous points.

Male. Length about 13–16 mm.; wing 12–15.5 mm.; antenna about 4–4.5 mm.

Frontal prolongation of head yellow, the dorsum very sparsely pruinose; no nasus; palpi obscure yellow, the terminal segment a trifle darkened. Antennae with the scape and pedicel light yellow, flagellum black; flagellar segments only weakly incised, a trifle longer than the verticils. Head brownish gray, the anterior vertex with a light brown central line; vertical tubercle low.

Pronotum light gray, with a narrow reddish brown median mark. Mesonotal praescutum light gray, with five reddish brown stripes, the three central ones narrow, representing the borders of two light gray intermediate stripes; lateral praescutal stripes broader; posterior sclerites of notum light gray, each scutal lobe with two reddish brown areas, the region of the suture light yellow; scutellum

and mediotergite with a narrow central dark line. Pleura obscure yellow, light gray pruinose; dorsopleural region light yellow. Halteres pale, the knob weakly infuscated, its apex narrowly yellowed. Legs with the coxae and trochanters yellow; remainder of legs broken. Wings with a weak brownish tinge, more yellowed at base and in costal region; a very restricted brown pattern, most evident as the stigmal darkening; obliterative band at cord and the poststigmal brightening relatively conspicuous, the former extending about to midlength of vein M_4 ; a small brightened marginal spot in cell $1st\ A$; a small darkened cloud at Sc_2 ; veins brown. Venation: R_s about twice $m-cu$; R_{1+2} entire; M_{3+4} very short with $m-cu$ close to the fork.

Abdomen obscure yellow, trivittate with light brown, the median stripe virtually continuous, the lateral pair more broken into wavy lines, the anterior end of each darker; basal sternites pale; outer segments more uniformly brownish black; hypopygium extensively yellow. Male hypopygium with the ninth tergite having a broad posterior emargination, at the base of which with a further quadrate notch which bears a small basal lobe; lateral tergal lobes smooth and somewhat more sclerotized than the remainder of tergite; setigerous punctures of tergite large but sparse. Ninth sternite with its appendage a low obtuse cushion. Outer dististyle widely expanded outwardly, the apex oblique. Inner dististyle with the beak relatively slender, not cut off from the main body of style by a ventral notch, as is the case in *aurantionota* and *usitata*; dorsal crest very low to virtually lacking; posterior crest very pale to practically hyaline; outer basal lobe low and obtuse, jutting caudad a trifle beyond the level of the posterior crest. Phallosome with five elements, including two pairs of blades, the lateral pair of which narrow very gradually into a long spine; the unpaired element has approximately the same size and shape, at apex forked into two subequal spinous points. Eighth sternite with the caudal margin virtually transverse, membranous; on either side of midline slightly more elevated and bearing a group of from 9 to 11 long pale setae that are directed caudad.

Habitat: California. *Holotype*: ♂, Stanford University, May (R. W. Doane); Alexander Collection, received in an exchange of specimens, determined as *usitata* Doane by the latter. *Paratopotype*: 1 ♂, reared; larva found February 20, 1915, adult emerged April 10, 1915.

Although related to *Tipula* (*Lunatipula*) *aurantionota* Alexander and *T. (L.) usitata* Doane, the present fly is readily told by the structure of the male hypopygium, as compared above.

***Pedicia (Pedicia) subobtusa* n. sp.**

Allied to *obtusa*; thoracic dorsum almost uniformly fulvous yellow, pleura yellow, vaguely patterned with darker; antennal scape brown, the remainder more brownish yellow; wings with the disk whitened, the posterior border weakly more grayish subhyaline, the usual brown pattern with the seam along vein *Cu* ending at the cord; abdomen uniformly light brown; male hypopygium with the basistyle produced caudad beyond the point of insertion of the dististyle as a broad obtuse glabrous blade, opposite the base of the dististyle with a brush of long reddish setae; dististyle with four strong black spinous setae along outer margin; tergal lobes very broad, obtuse.

Male. Length about 27 mm.; wing 20 mm.

Rostrum and palpi brown. Antennae with scape brown, pedicel and flagellum more brownish yellow; basal flagellar segments short and crowded, the outer ones more elongate, with longer verticils. Head grayish brown; vertical tubercle low, entire.

Thoracic dorsum almost uniformly fulvous yellow, the sides of the pronotum more darkened; lateral praescutal borders more pruinose; posterior sclerites of notum yellow, silvery pruinose. Pleura obscure yellow, vaguely patterned with darker, more distinctly so on the dorsopleural membrane behind the spiracle. Halteres with stem pale, knob infuscated. Legs with the coxae yellow, sparsely pruinose; remainder of legs yellow, the tips of the femora and tibiae weakly infuscated; outer tarsal segments dark brown. Wings with the posterior border weakly grayish subhyaline, the disk more whitened; the usual brown pattern of the subgenus present, the dark seam along vein *Cu* ending at the cord but somewhat more angularly bent at *m-cu* than in *obtusa*; veins pale, including those in the darkened areas. Venation: Petiole of cell R_4 about two-thirds the oblique sinuous *r-m*; M_{3+4} about two-thirds M_4 alone; petiole of cell M_1 a trifle longer than *m*.

Abdomen, including hypopygium, virtually unicolorous light brown. Male hypopygium with the basistyle produced caudad beyond the point of insertion of the dististyle as a broad obtuse glabrous blade, opposite the base of the dististyle with a concentration or brush of long reddish setae. Dististyle approximately as in *obtusa*, differing in the details; outer margin before the hatchet-shaped lobe with four strong black spinous setae. Tergal lobes very broad, obtuse.

In *obtusa* the dististyle is terminal in position and broadly fused with the apex of the basistyle which bears no modified brush of

setae; dististyle of slightly different shape and armature; tergal lobes narrow, acute at tips.

Habitat: California. *Holotype*: ♂, Lake Tahoe, Placer Co., altitude 6000 feet, July 3, 1947 (C. P. Alexander).

The present species had been confused by me with *Pedicia* (*Pedicia*) *obtusa* Osten Sacken, which until very recently had been known only from the brief description provided by Osten Sacken in 1877. In 1948 the latter fly was re-discovered in northern California (Lassen Volcanic National Park, *Schulz*) and in Oregon (Peavine Ridge, Station 3A, *Fender*) and proved to be quite distinct from the present species, particularly in the structure of the male hypopygium, as compared above. Various records for *obtusa* by Aldrich (1895) and Coquillett (1900) refer to the entirely distinct *P. (P.) parvicellula* Alexander. Material taken in Siskiyou County, California, September 27–October 6 by James Behrens and recorded by Osten Sacken (1895) as *obtusa* may refer to that species or to the present fly.

Swarming of *Eurema Nicippe* (Cramer), (Lepidoptera: Pieridae). The author noted in the late fall of 1940 a swarm of *Eurema nicippe* (Cramer), fifteen miles southeast of Fort Worth (97° 10' W., 32° 35' N.). The swarm, of about two or three hundred specimens, was located on a low bush. They were protected from the cool brisk northwest wind by being in the low eroded creek bed which ran perpendicular to the wind. The sky was overcast and the specimens were crouched from the cold. The underside of all specimens was suffused brick red. This helps to substantiate the statement made by Don B. Stallings and Robert Whittaker (*Ent. News*; Vol. 55, 67–71, 87–92, 1944), of the existence of a distinct seasonal *generatio hiemalis* occurring in the South and Southwest regions.—KENT H. WILSON, FORT WORTH, TEXAS.

THE MISSOURI BEE-KILLER, PROCTACANTHUS MILBERTII MACQ. (ASILIDAE: DIPTERA).

By S. W. BROMLEY, Bartlett Tree Research Laboratories,
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Proctacanthus milbertii Macquart is a widely distributed large Asilid occurring from Mexico to British Columbia east to Ontario, Ohio, Virginia, and Florida. *Milbertii* has for its habitat fields, pastures and dry prairies where the soil contains a considerable admixture of sand. Alighting on or near the ground, *milbertii* is always conspicuous because of its active flight and sonorous buzzing. In Southern Alabama, Colonel F. S. Blanton stated that it has received the common name of "Boo-hoo" fly. In a pasture in Missouri in 1923 where this species was particularly abundant I called it to the attention of a farmer explaining what it was and what it did. "Well, what do you know?" he said when I had finished, "I always thought they were a kind of horse fly!" In this he was anticipated a couple of centuries by the great Linnaeus who gave this group of flies the name *Asilus* (the ancient name for flies which tormented cattle) in the belief that they were molesters of stock and cattle, a habit in which no robber fly today is known to indulge. In his 2nd Annual Report on Missouri Insects, p. 123, 1870, C. V. Riley described the present species as *Asilus missouriensis*, calling it the "Missouri Bee-killer" in the belief that it preyed principally on the honey-bee. That this was an erroneous impression, I pointed out in my paper on Bee-killing Robber flies, *Journal of the N. Y. Ent. Society*, 38, 172 (1930).

In the present paper, reviewing a compilation of 659 prey records, honey-bees comprise less than 4% of the total. *Milbertii* prefers Lepidoptera and Orthoptera which comprise 75% of its prey. Its attacks on other groups of insects are more or less perfunctory and usually occur in the absence of its favorite prey. In the field these flies are constantly seen to betray interest in grasshoppers, butterflies and moths, giving chase the instant they are sighted. The honey-bee prey listed in the present paper were taken under special conditions where the bees were forced to fly close to the earth in cut clover or alfalfa fields where blossoms were within a few inches of the ground.

It is of interest to note the similarity in the type of prey chosen by *milbertii* and the African *Alcimus setifemoratus* Hobby, another large, slender, streamlined species of similar size which was re-

corded by Hobby as feeding on Lepidoptera and Orthoptera in 71% of 231 instances of preying (Hobby, B. M. Rhodesian Asilidae and their Prey collected by C. F. M. Swynnerton: Jour. Animal Ecology, 4, 1, pp. 90-112, May, 1935).

"Give a dog a bad name and hang him." This old saying has certainly applied to *Protacanthus milbertii*. The name "Missouri bee-killer" still sticks. In Missouri (1923) I found apiarists destroying *P. milbertii* by the scores because they thought it killed their bees. I tried to track down a bona fide case of bee-killing at that time but was unable to do so.

During the summer of 1946, Dr. Haseman, Mr. Enns and Mr. Craig all looked diligently for a case of *Milbertii* catching honey-bees in Missouri and found only one! In the course of the summer they found *Mallophora orcina* feeding on honey-bees on 5 occasions, *Diognites salutans* twice and *Promachus hinci* once. My friends in Texas have been on the look-out for a *milbertii* with honey-bee prey since 1932 and to date none has materialized. Quite evidently, *milbertii* is of little or no consequence as a bee-killer, at least as compared with *Saropogon dispar*, *Mallophora orcina*, *Diognites symmachus* and *D. angustipennis* all of which frequently cause losses to apiarists in Texas.

Milbertii does not occur in the Northeastern states where its place is taken by the closely related *P. philadelphicus*, much more of a bee-killer, although even here the killing of bees never reaches economic importance.

PREY OF PROCTACANTHUS MILBERTII

LEPIDOPTERA. 260 records.

Cotton leaf-worm moth, *Alabama argillacea* Hbn. 55, College Station, Texas, Sept. 1933, in large cow-pasture (SWB). 1, Sept. 27, '33, same locality (H. J. Reinhard), 1, Sept. 21, '33 (H. J. Reinhard). Cotton leaf worm larvae, 1885 Report on Cottonworm, Rept. 4, U. S. Ent. Commission p. 99 (C. V. Riley).

Cotton Bollworm moth, *Heliothis obsoleta* Fabr. 19, College Station, Texas, Sept. 1933, in large cow pasture (SWB). 3, same locality, Sept. '32, in *Andropogon* prairie (SWB). 2, Forestburg, Texas, 9-17 to 9-21, '41 (L. H. Bridwell).

Cabbage butterfly, *Pieris rapae* L. 40 + Cook, Manual of Apiary, p. 415 Michigan (1888). 24, Columbia, Mo., Aug. 1923, in

old field near vegetable garden (SWB). 32, East Lansing, Mich., July–Sept. '34 (in old field next to a cabbage patch (SWB)).

Alfalfa butterfly, *Eurymus eurytheme* Boisd. U. S. D. A. Bull. 124, Aug. 28, 1914 (Wildermuth). 12, Columbia, Mo., July–Aug. '23, in cut alfalfa field (SWB).

Clover butterfly, *Eurymus philodice* Godt. 23, East Lansing, Mich., Aug. '34, in cut clover field (SWB).

Cutworm moth, *Agrotis ypsilon* Rott. 14, East Lansing, Mich., Aug. '34, in field near vegetable garden (SWB).

Fall armyworm moth, *Laphygma frugiperda* S. & A. 1, Columbia, Mo., Aug. '29, 1923 (SWB).

Hummingbird moth, *Hemaris thysbe* Fabr. 1, Lucas Co. Ohio, Aug. 21. (R. C. Osburn).

Buckeye butterfly, *Junonia coenia* Hbn. 4, Forestburg, Texas, 9–20 to 9–30, 1941 (L. H. Bridwell).

Skipper, *Apatelodes campestris* Bvd. 1, College Station, Texas, Sept. 17, '33 (SWB). 1, Columbia, Mo., Aug. 29, '23 (SWB).

Yellow skipper. 1, Columbia, Mo., Aug. 29, '23 (SWB).

Dried Clover Moth, *Hypsopygia costalis* Fabr. 1, College Station, Texas, Sept. 30, '32 (SWB).

Cosmopolitan butterfly, *Vanessa cardui* L. Clark Co. Ks. 1911 (F. X. Williams) Record from U. Ks. (Beamer).

Small yellow butterfly, *Eurema* sp. 1, College Station, Texas. Sept. 21, '33 (H. J. Reinhard). 5, same locality, Sept. 21–27, '33 (SWB).

Gulf fritillary, *Dione vanillae* L. 3, College Station, Texas. Sept. 21–27, '33 (SWB).

Swallow-tail butterfly, *Papilio philenor* L. 2, College Station, Texas, Sept. 21–27, '33 (SWB).

Blue lycaenid butterfly. 1, Columbia, Mo., Aug. 7, '23 (SWB).

Skipper, *Polites taurus* Fabr. 2, Columbia, Mo., Aug. 29, '23 (SWB).

Medium-sized skipper. 1913, late July or early August. Colfax Co. N. M. (W. R. Walton), Proc. U. S. N. M. vol. 48, p. 174, 1914.

Moth, *Neleucania albilinea* Hbn. 1, Columbia, Mo., Aug. 29, '23 (SWB).

ORTHOPTERA. 253 records.

Rocky Mountain locust, solitary phase, *Melanoplus mexicanus* Sauss. 42, College Station, Texas, Sept. '33 (SWB). 27, Columbia, Mo., Aug. '23, in former wheat plats (SWB). 24, East Lansing, Michigan, Aug., Sept., '34, in old field (SWB). 1, County 77, Iowa, Aug. 27, '36 (Bernard Berger).

Rocky Mountain locust, swarm phase, *Melanoplus spretus* Thomas. L. O. Howard, Century Dictionary, vol. IV, p. 2743, 1899 (1901 Copyright edition).

Red-legged grasshopper, *Melanoplus femur-rubrum* Deg. 24, Columbia, Mo., Aug. '23. 15, College Station, Texas, Sept. 1933 (SWB). 8, East Lansing, Michigan, Aug. '34 (SWB).

Melanoplus bispinosus Scudder. 51, College Station, Texas, Sept. 1933 (SWB) in large cow pasture.

Grasshopper nymphs. N. Mexico. Walton, *Proc. U. S. N. M.* vol. 48, 174, 1914.

Syrbula admirabilis Uhler. 2, Foresburg, Texas. Sept. 20 and 24, '41 (L. H. Bridwell). 2, Columbia, Mo., Aug. 8, '23 (SWB). 1, same locality, 8-24-40 (W. R. Enns).

Hippiscus rugosus (nymph). 1, Forestburg, Texas. Sept. 25, '41 (L. H. Bridwell).

Tettix sp. 1, Forestburg, Texas. 9-24-41 (L. H. Bridwell).

Mestobregma fuscifrons Stal. 12, College Station, Texas, Sept. 1933 (H. J. R. & SWB).

Spharagemon cristata. 6, College Station, Texas, Sept. 27, '33. (det. Little).

Cambylacantha olivacea Scudder (Det. Little) nymph. 1, College Station, Sept. 27, '33 (SWB).

Camnula pellucida Scudder. 11, East Lansing, Mich., Aug. 19-25, '34, in old field (SWB).

Trimerotropis citrina Scudder (Det. Little). 4, College Station, Texas, Sept. 1933 (SWB).

Cone-head, *Neoconocephalus* sp. 1, Columbia, Mo., Aug. 29, '23 (SWB).

Katydid, *Scudderia texensis* S & P (Det. Little). 1, College Station, Texas, Sept. 27, '33 (SWB).

Cricket, *Nemobius fasciatus* Deg. (Det. U. S. N. M.). E. Lansing, Mich., Aug. 11, '34 (SWB). Newtown, O. 8-25-38 (SWB).

HYMENOPTERA. 71 records.

Honeybee, *Apis mellifera* L. 4, Riley, "Missouri" (probably St. Louis) "Two males and two females, all captured while sucking honey-bees." 2nd Annual Report, State Entomologist, Missouri, p. 123 (1870). 1, Detroit, Mich. Mich. Agr. College. Collection. Oct. 1, 1910. 1, Grand Rapids, Mich. Oct. 11, 1915, Mich. Agr. Coll. Haseman, letter of July 30, 1946, "I have seen one kill and suck the blood from honey-bees in my own apiary in the country." Columbia, Missouri. 1, Craig, W. S. Sept. 11, '46. Columbia, Mo. 10, East Lansing, Mich., July-Sept. 1934. In cut sweet yellow clover fields (SWB). 1, Birch Run, Mich., Aug. 30, '34 (SWB) 2, Adams Township, Section 23, Lucas Co., Ohio, Aug. '35, in cornfield (R. T. Everly). 2, near Cincinnati, Ohio, Aug. 25, 1938, in dry, old fields near goldenrod (SWB).

Bumblebee (female) *Bombus americanorum* (Fabr.). 1, Forestburg, Texas, Sept. 25, '41 (L. H. Bridwell). 5 workers, College Station, Texas, Sept. 1933, near clumps of blossoming Buffalo bur in large cow pasture. (SWB).

Bumblebee (worker), *Bombus auricomus* Robts. 2, College Station, Texas, Sept. 1933, near clumps of blossoming Buffalo bur in large cow pasture. (SWB).

Bombus impatiens Cress. worker. 1, East Lansing, Michigan, Aug. 23, '34, in alfalfa field (SWB).

Bombus fervidus (Fabr.) worker. 1, East Lansing, Michigan, Aug. 4, '34, in alfalfa field. (SWB).

Bombus impatiens Cress. 1, Montgomery, Ohio, Aug. 25, '38, in goldenrod field (SWB).

Melon bee, *Melissodes bimaculata* (Lep.) 1, Adams Township, Section 23, Lucas Co., Ohio, Aug. 14, '35, in cornfield (R. T. Everly).

Sand bee, *Andrena aliciae* Robt. (det. U. S. N. M.) 1, East Lansing, Michigan, Aug. 12, '34 (SWB).

Halictus ligatus Say. (det. U. S. N. M.) 1, Columbia, Mo., Aug. 29, '23 (SWB). *Ceratina calcarata* Robt. (det. U. S. N. M.) 1, East Lansing, Mich., Aug. 26, '34 (SWB).

Megachile pollicaris Say (det. T. B. Mitchell). 1, College Station, Texas, Sept. 27, '33 (SWB).

Megachile latimanus Say (det. T. B. Mitchell). 1, E. Lansing, Mich., Aug. '34 (SWB).

Worker Yellowjackets. *Vespa maculifrons* Buy. 2, E. Lansing, Mich., Aug. 25, '34 (SWB). *Vespa arenaria* 2, Sandpoint, Huron Co., Mich., Sept. 9, '24 and Port Austin, Huron Co., Mich., Sept. 9, '24 (F. M. Gaige).

Brown Wasps. *Polistes variatus* Say. 1, East Lansing, Mich., Sept. '34 (SWB). *Polistes pallipes* Lep. 1, East Lansing, Mich. Sept. '34 (SWB). *Polistes canadensis* L. 1, Columbia, Mo., Sept. 16, '40 (W. R. Enns).

Spider wasps. 1, *Psammochares* sp. 1, Sanford, N. C., Oct. 5, '21 (T. B. Mitchell). 1, *Pompilus luctuosus* Cresson. 1, Forestburg, Texas, Sept. 25, '41 (L. H. Bridwell). 1, Port Austin, Huron Co., Mich., Aug. 28, '24 (F. M. Gaige).

Solitary wasps. *Cerceris* sp. 1, East Lansing, Mich., Aug. 5, '34 (SWB). 1, Columbia, Mo., Aug. 1923 (SWB). 1, College Station, Texas, Sept. 23, '33 (SWB). *Larropsis distincta* Sm. 2, East Lansing, Mich., Aug. 4 and 11, '34 (SWB). 1, Boonville, Mo., Sept. 16, '39 (W. R. Enns). *Lyroda subita* Say. (det. U. S. N. M.). 2, E. Lansing, Mich., Aug. 5 and 11, '34 (SWB). *Lestica producticollis* Pack. (det. U. S. N. M.). 1, E. Lansing, Mich., Aug. 5, '34 (SWB). *Astata leuthstromi* Ashm. 1, E. Lansing, Mich., Aug. 4, '34 (SWB). Sand wasp, *Sphex procerus* Dahlb. 1, College Station, Texas, Aug. 27, '33 (H. J. Reinhard). Sand hornet, *Bembix spinolae* Lep. 1, East Lansing, Mich., Aug. 16, '34 (SWB).

Parasitic wasps. *Tiphia inornata* Say. 2, Forestburg, Texas, Sept. 25, '41 (L. H. Bridwell). 1, Steuben Co. Indiana. Aug. '03 (U. S. Nat. Museum) *Amblyteles* sp. 1, E. Lansing, Mich., Sept. 9, '34 (SWB).

Ants. Black Ant, *Formica subsericea* Say. 1 female, 3 males, E. Lansing, Mich., Aug. 5 to 26, '34 (SWB). Brown ant, *Formica fusca* L. 2 males, E. Lansing, Mich., Aug. 3 and 11, '34 (SWB). Army ant, male, *Eciton opacithorax* Em., College Station, Texas, Sept. 28, '33 (SWB).

COLEOPTERA. 38 records

Colorado Potato Beetle, *Leptinotarsa decemlineata* Say. Chittenden, Bureau Ent. Circ. 87, p. 11, 1907. 5, College Station, Texas, Sept. '33, near clumps of Buffalo bur in large cow pasture (SWB). 8, East Lansing, Mich. Aug.-Sept. '34, in cow pasture near potato field (SWB).

Spotted cucumber beetle, *Diabrotica duodecimpunctata* Fabr. 4, Columbia, Mo., Aug. 1923, in field near vegetable garden (SWB). 3, East Lansing, Mich. Aug.-Sept. '34, in field near vegetable garden (SWB).

Tiger Beetles. *Cicindela obsoleta* say. 6, College Station, Texas, Sept. '33, in sandy pasture (SWB). *Cicindela hirticollis* Say. 3, College Station, Texas, Sept. '33 (SWB). *Cicindela generosa* Dej. 2, Sandport, Huron Co., Mich., Sept. 13, '27 and Port Austin, Mich., Aug. 26, '34 (F. M. Gaige). *Cicindela purpurea* Oliv. 1, Beachland, B. C. Wallis, Can. Ent. May 1913, vol. XLV, 5, p. 135. *Cicindela 12-guttata* Dej. Davis, J. J. Nat. Hist. Survey Illinois, Bull. XIII, Article V, p. 89, 1919.

Tumble bugs. *Canthon laevis* Drury. 2, College Station, Texas, Aug. 27, '33 (H. J. Reinhard).

Bumble beetles. *Euphoria inda* L. 1, East Lansing, Mich. Aug. 23, '34 (SWB). *Amphicoma* sp. 2, Forestburg, Texas, Oct. 1 and 4, '41 (L. H. Bridwell).

DIPTERA. 36 records.

Carriion Screw-worm fly, *Cochlyomyia macellaria* Fabr. 8, College Station, Texas, Sept. '33 near dead opossum in large cow pasture. (SWB). 11, East Lansing, Mich. Aug. 25 and 28, '34, near dead cow in dry gully. (SWB).

Robber flies. Bee-catcher, *Diogmites symnaehus* Loew. 2, College Station, Texas, Sept. 14, '33 (T. McGregor) and Sept. 27, '33 (SWB). Field Fly-hawk, *Erax rufibarbis* Macq. 2, College Station, Texas, Sept. 27 and 28, '33 (SWB) and 2, Sept. 19, '33 (H. J. Reinhard). *Asilus paropus* Walker. 2, East Lansing, Mich. Aug. 15 and 18, '34 (SWB). *Stichopogon trifasciatus* Say. 1, Forestburg, Texas, Sept. 27, '41 (L. H. Bridwell). *Proctaeanthus milbertii* Macq. 1, a male killed by a female, East Lansing, Mich., Aug. 11, '34 (SWB). *Asilus sadyates* Walker. 1, Aug. 26, '34, East Lansing, Mich. (SWB). *

- Bee flies. *Villa* sp. 1, E. Lansing, Mich. Aug. 11, '34 (SWB).
Systoechus vulgaris Loew. 1, East Lansing, Mich. Aug. 25, '34 (SWB).
 Flesh fly, *Sarcophaga communis* Park. 1, Milford, Ohio Aug. 25, '38 (SWB).
 Drone fly, *Eristalis vinctorum* Fabr. 1, College Station, Texas, Sept. 21, '33 (H. J. Reinhard). 1, Small Tachinid fly, *Zenillia* sp., College Station, Texas, Sept. 21, '33 (H. J. Reinhard).

HEMIPTERA-HOMOPTERA. 19 records.

- Squash-bug, *Anasa tristis* DeGeer. 6, East Lansing, Mich., Sept. 1934, along large field of squash (SWB).
 Stink bugs. *Euschistus servus* Say. 4, Adams Township, Ohio, Aug. 1935 (R. T. Everley) *Peribalus limbolaris* Stal. 1, East Lansing Mich., Aug. 11, '34 (SWB) (det. U. S. N. M.) *Cosmopepla bimaculata* Thomas (det. U. S. N. M.) 1, East Lansing, Mich. Aug. 5, '34 (SWB). *Hymenarcys aequalis* Say (det. U. S. N. M.) East Lansing, Aug. 5, '34 (SWB).
 Treebug, *Brochymena 4-pustulata* Fabr. 1, East Lansing, Mich., Aug. 5, '34 (SWB). Bush-clover stink-bug, *Alydus eurinus* Say. 2, East Lansing, Mich., Aug. 12-18, '34 (SWB).
 Leafhopper, *Gypona* sp. (det. U. S. N. M.) East Lansing, Mich., Aug. '34 (SWB).
 Buffalo Tree-hopper, *Cercsa bubalus* Fabr. 1, East Lansing, Mich., Aug. 12, '34 (SWB).

ODONATA. 1 record.

- Aeschna tuberculata* Walker. 1, East Lansing, Mich., Aug. 1934 (SWB). The dragon fly was hit by the rim of the collector's net, injuring the abdomen, so that it mounted in circles skyward and then circled slowly toward the ground. About four feet from the ground it seemed to drop suddenly. An investigation disclosed that the dragon fly had been seized by the Asilid which was now resting on the ground with the big *Aeschna* in its grasp. The incident was very reminiscent of an observation made by Dr. Robert B. Gordon in North Central Ohio a number of years ago. A good sized chicken was hit by a car and, although badly injured, was not killed. A cooper hawk struck the flopping bird and finished it off, demonstrating that predatory creatures sense weakness or injury in their prey and that such weakness will facilitate their capture.

NOTES ON PUERTO RICAN BITING MIDGES OR CULICOIDES (DIPTERA: CERATOPOGONIDAE)

By IRVING FOX, School of Tropical Medicine,
San Juan, Puerto Rico.

Progress in the taxonomy of the Neotropical species of *Culicoides* is greatly handicapped because they are known, for the most part, from females only. Of the sixty odd species reported from this region, the males of more than two-thirds are unknown, an unfortunate situation because that sex in its hypopygium nearly always exhibits much better characters for separation of species than does the female. In this paper the male hypopygia of five Puerto Rican species are described and illustrated, and also important characters of the females not brought out in the original descriptions are emphasized; four of these species are new records for Puerto Rico.

The material which provided the basis for this work is in the entomological collection of the Department of Medical Zoology, School of Tropical Medicine, San Juan, Puerto Rico, where it accumulated through the efforts of several collectors. Particular thanks are due in this connection to Capt. Charles E. Kohler, U. S. Public Health Service, John W. H. Rehn, Columbia University and Capt. George D. Penick, M. C., Army of the U. S. for their courtesy in permitting examination of their light trap collections.

Culicoides hoffmani Fox

Culicoides hoffmani Fox, Ent. Soc. Amer. Ann. 39: 251, Figs. 6 and 9, 1946.

Male hypopygium.—Ninth tergite with broad triangular apico-lateral processes. Aedoeagus distally divided into three processes (Fig. 1, a); harpes and processes of the sidepiece as shown in Fig. 1, c. Ninth sternite broadly notched.

Female.—Antenna with the segments in a series continuously increasing in length without an abrupt change between segments 10 and 11. Palpus (Fig. 1, d) with the second segment considerably shorter than the third, the pit of the latter circular and prominent. Spermathecae (Fig. 1, b) with the base of the ducts broad and sclerotized for a more than usual distance.

Material.—The comments and illustrations concerning this species are made from a male and a female specimen, selected from a small series, reared out of tree-hole débris collected at Mameyes, Puerto Rico on November 5, 1948. The male is designated the

allotype. Several males and females reared out of tree-hole debris collected at Luquillo, Puerto Rico, May 12, 1932 are also in the collection.

Remarks.—This species, originally described from Trinidad, is very similar to the Brazilian *C. debilipalpis* Lutz in the structure of the female palpus and in the arrangement of the light and dark spots of the wing. It differs however in the palpus which in *debilipalpis* has the second segment as long as the third. The male of *debilipalpis* has not been described.

Culicoides borinqueni Fox and Hoffman

Culicoides borinqueni Fox and Hoffman, Puerto Rico Jour. Pub. Health and Trop. Med. 20: 110, Fig. 4, 1944.

Male hypopygium.—Ninth tergite with the anterior border notched, the apico-lateral processes long. Aedoeagus and harpes as shown in Figs. 2, a and d. Inner process of the sidepiece slender and acuminate. Ninth sternite broadly excavated.

Female.—Antenna with the last five segments markedly differing in length and shape from the others, the change between segments 10 and 11 being abrupt. Palpus (Fig. 2, e) with the second segment shorter than the third, the latter massive with a large, distinct pit. The wing, illustrated more accurately than in the original description, is shown in Fig. 2, b. Spermathecae (Fig. 2, c) with the base of the ducts sclerotized for a short distance.

Material.—Re-described and illustrated from the female holotype (Fig. 2, e), a female paratype (Figs. 2, b and c) and the male allotype. The species has not been collected again since it was first discovered at Palmas Abajo, Puerto Rico in 1931. The published record from Luquillo, P. R. (Fox, 1946, p. 252) was an error of determination, *C. hoffmani* being involved.

Remarks.—While very similar to *debilipalpis* in the female wing as has been pointed out by Dr. Macfie (1948, pp. 73 and 87), this species is immediately distinguished from it by the antenna and the palpus which are very different from those of the Brazilian form.

Culicoides trilineatus Fox

Culicoides trilineatus Fox, Ent. Soc. Amer. Ann. 39: 250, Figs. 5 and 11, 1946.

Male hypopygium.—Ninth tergite notched, the apico-lateral processes broad and triangular. Aedoeagus and harpes as shown in Figs. 3, and c. Ninth sternite broadly excavated.

Female.—Antenna with the segments continuously increasing in length without an abrupt change in shape between segments 10 and 11. Palpus (Fig. 3 d) with the second segment almost as long as the third. Cell M_1 of the wing with two light spots but the proximal one smaller and less distinct than the distal. Spermathecae (Fig. 3, b) with the base of the ducts narrow and sclerotized for a long distance.

Material.—The male is described from a specimen, designated the allotype, which was reared out of tree-hole debris collected November 5, 1948 at Luquillo, Puerto Rico. The comments and illustrations concerning the female were made from two specimens which emerged from the same material.

Remarks.—This species, which was originally described from St. Thomas, is also similar in certain respects to *debilipalpis* as has been mentioned by Dr. Macfie (1948, p. 72). The female differs however in the peculiar pattern of the mesonotum and in the wing which is provided with many macrotrichia in the anal cell, characters which were illustrated in the original description. The fact is that all three of the above species show strong resemblances in the pattern of light and dark spots of the female wing to *debilipalpis*. One may possibly be the same as the Brazilian species known from the female only (although the writer does not think so) but all three cannot be because the hypopygia of the males are markedly different from each other, not even suggesting any relationship.

***Culicoides guttatus* (Coquillett)**

Ceratopogon guttatus Coquillett, N. Y. Ent. Soc. Jour. 12: 35, 1904.

Male hypopygium.—Aedoeagus (Fig. 4, a) differing from the other members of the subgenus (*Hoffmania* Fox, 1948) in that the tip is button-like rather than ball-like. The harpes (Fig. 4, d) are similar to those of *C. diabolicus* Hoffman, but united for a greater portion basally than in that species.

Female.—Antenna with the segments in a series continuously increasing in length without an abrupt change between segments 10 and 11. Wing (Fig. 4, b) characterized particularly by the presence of a small isolated dark spot near the tip of vein R_{4+5} and by the dark cross-vein. Spermathecae (Fig. 4, c) with the base of the ducts sclerotized for a very short distance.

Material.—The male was described and illustrated from a specimen taken in a light trap at Camp Tortugero, Puerto Rico, August 6, 1948, which is designated the allotype. The illustrations of the

female were made from a specimen in the same lot (Fig. 4, b) and from another (Fig. 4, c) taken in a light trap at Camp O'Reilly, Puerto Rico, Aug 30, 1948.

Remarks.—The species believed to be *guttatus* is widely distributed in the Neotropical Region, for in addition to these from Puerto Rico, specimens have been studied from Brazil, Venezuela and Mexico. Dr. Macfie (1948, p. 70) indicates six possible synonyms—*diabolicus* Hoffman, *flariferus* Hoffman, *bimaculatus* Floch and Abonnenc, *painteri* Fox, *pseudodiabolicus* Fox and *trinidadensis* Hoffman. From the zoological point of view there is little doubt that this species differs from the one known as *diabolicus* because the hypopygia are different. If Dr. Macfie is right in his principal point, a nomenclatorial one, that *diabolicus* Hoffman is the same insect which Coquillett described as *guttatus* then the species under consideration would appear to require a new name since *bimaculatus* (known only from the female) is said to lack the dark cross-vein, and the other names have already been disposed of (Fox, 1948). The late Dr. W. A. Hoffman believed the species here re-described, of which he had female specimens from Brazil, to be *guttatus* and the writer concurs in this opinion.

Culicoides loughnani jamaicensis Edwards

Culicoides loughnani var. *jamaicensis* Edwards, Bul. Ent. Res. 13: 165, Pl. III, fig. 10, 1922.

Male hypopygium.—Ninth tergite straight without a distinct notch, the apico-lateral processes large. Aedoeagus and harpes as shown in Figs. 5, a and c. Inner process of the sidepiece very

EXPLANATION OF PLATE I

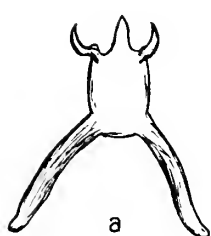
FIG. 1. *Culicoides hoffmani* Fox. a, aedoeagus; b, spermathecae; c, harpes; d, female palpus.

FIG. 2. *C. borinqueni* Fox and Hoffman. a, aedoeagus; b, female wing; c, spermathecae; d, harpes; e, female palpus.

FIG. 3. *C. trilineatus* Fox. a, aedoeagus; b, spermathecae; c, harpes; d, female palpus.

FIG. 4. *C. guttatus* (Coq.) a, aedoeagus; b, female wing; c, spermathecae; d, harpes.

FIG. 5. *C. loughnani jamaicensis* Edwards. a, aedoeagus; b, spermathecae; c, harpes; d, female mesonotal pattern; e, female palpus.



a



b

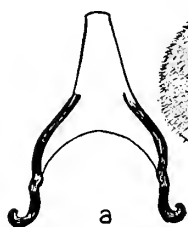


c

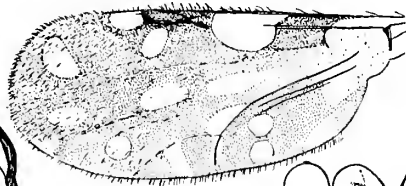


d

1. *hoffmani*



a



b



c

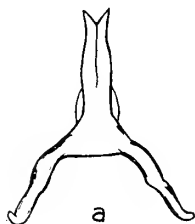


d



e

2. *borinqueni*



a



b

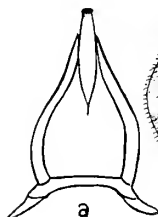


c

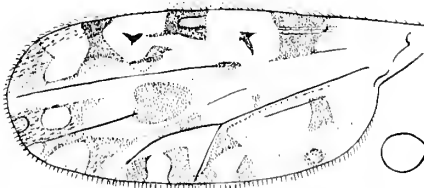


d

3. *trilineatus*



a



b

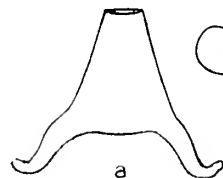
4. *guttatus*



c



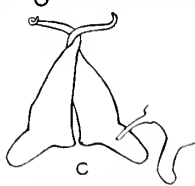
d



a



b



c



d



e

5. *l.jamaicensis*

narrow. Membrane between the aedoeagus and the ninth sternite not spiculate.

Female.—Eyes very close together, contiguous at least partly. Antenna with the last five segments markedly different in length and shape from segments 4–10 which are subequal; the change between segments 10 and 11 abrupt. Palpus (Fig. 5, e) with the third segment much larger than the second and bearing a circular pit on a prominent tubercle. Mesonotum with a distinct pattern as shown in Fig. 5, d. Wing with the light and dark spots arranged exactly as shown in the photograph illustrating the original description. Spermathecae (Fig. 5, b) with the base of the ducts not sclerotized.

Material.—The comments and illustrations concerning this species are based on a male and a female specimen from Sabana Seca, Puerto Rico collected by means of a light-trap August 22, 1948. The male is designated the allotype.

Remarks.—This insect was originally described from Jamaica and has been reported from the Canal Zone (Hoffman 1925, p. 283) and Mexico (Macfie 1948, p. 80). It is similar to *copiosus* Root and Hoffman but differs in several important features. The hypopygium is different in that the ninth tergite is straight and there is no spiculate membrane between the aedoeagus and the ninth sternite. The female wing differs in that the distal light spot in cell R_5 reaches the anterior border while in *copiosus* it does not do so. The spermathecae of *jamaicensis* differ from those of *copiosus* in that no part of the base of the ducts is sclerotized.

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BOOK NOTES

Days Without Time, by Edwin Way Teale. xiv + 283 pp., 144 photographs. 7 × 10 ins., cloth bound. 1948. Dodd, Mead & Company, New York, N. Y. (Price, \$6.00)

This book is a series of recollections of those days when Teale was able to forget about schedules and deadlines and become acquainted with the wonders of the natural world. For him it is memories of days without time.

The material is divided into 29 chapters and except for the first one which is an introduction they deal with specific adventures in the world of nature. Some of the chapter headings are Bird Invasion, Night Above the City, Birds In the Wind, Trees That I Remember, Wonder Eggs, The Autumn Shore and Green Fire. Eighty pages of excellent photographs, many full size, accompany the text.

For the most part the material is descriptive and it is so skillfully presented that one has the feeling that he is seeing the actual scenes which Teale observed. Because of the general excellence of the book it is difficult to select any chapter as being outstanding in its exposition. Naturally each reader will find certain chapters which engage his attention more than others. The chapters on Green Fire and Wonder Eggs were particularly fascinating to this reviewer yet all of the chapters of *Days Without Time* are extremely interesting and are recommended for those who seek pleasure in good books.—GEORGE S. TULLOCH, Merrick, N. Y.

The Corixidae of the Western Hemisphere. By H. B. Hungerford (including a monograph on the *Trichocorixa* by R. I. Sailer). University of Kansas Science Bulletin, Vol. XXXII, pp. 1–827, 112 plates, one in color, 19 text figures, 6 × 9 ins., cloth bound. Printed by Fred Voiland, Jr., Topeka, Kansas. November 25, 1948.

This paper is a monographic revision of the family Corixidae of the Western Hemisphere in which Dr. Reece I. Sailer contributed the section dealing with the genus *Trichocorixa*. In addition to the taxonomic considerations there is included material dealing with the habits and morphology of the corixids. Special attention is given to the technique of identifying these bugs. A separate section is devoted to a glossary of terms used in the paper.

Prior to this paper 165 species and 6 subspecies of Corixidae were known from the Western Hemisphere. This paper adds descriptions of 44 new species (7 by Sailer) and 6 new subspecies (3 by Sailer) and brings together information on the 209 species and 12 subspecies known to occur in this hemisphere. Following the bibliography given for each species there are sections dealing with size, color, structural characteristics, location of types, comparative notes and data on distribution which in many cases is supplemented by maps. Habitat notes are included whenever information is available.—GEORGE S. TULLOCH, Merrick, N. Y.

Spider Feeds on Honeybee. While checking on honeybee mortality in front of beehives at the North Logan Experimental Farm on September 8, 1948, a case of spider predatism was observed. Mr. Frank E. Todd called the writer's attention to a crab spider which was feeding on a worker honeybee. This was observed at 7:40 a.m. During the night before, the temperature in the nearby weatherbox recorded 37°F, and the morning was cool. The spider acted cold, moved its legs when handled, but did not release its hold on the workerbee until both spider and prey had been dropped into a vial of 70 percent alcohol.

The spider was sent to Dr. W. J. Gertsch, who identified it as a female *Xysticus cunctator* Thorell. Dr. Gertsch explained that this species is a "cousin" of the *Misumena calycina* L. which the writer had observed to be feeding on a worker honeybee in front of a beehive at Holladay, Utah on July 9, 1947.—G. F. KNOWLTON, Logan, Utah.

BULLETIN

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VOL. XLIV

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No. 2

NEW SPECIES OF NEARCTIC CADDIS FLIES.

By D. G. DENNING, Laramie, Wyoming.

Recent examination of several collections of Trichoptera have revealed a number of new species ten of which are described herein. Grateful acknowledgment is made to Dr. C. P. Alexander and members of his staff at the University of Massachusetts and to Dr. R. H. Beamer of the University of Kansas for collecting the majority of the species described in this paper. Unless indicated otherwise types are in the author's collection at the University of Wyoming.

Rhyacophila ebria, n. sp.

This species, a member of the *rotunda* Banks *norcuta* Ross complex, is most closely related to *rotunda*. It can easily be separated from that species by the shorter more robust tenth tergite with a short rather than deep and wide mesal notch, by the acute rather than blunt lateral arms of the aedeagus and several other details of the genitalia.

Male.—Length 10–11.5 mm. Head, body and base of legs black, wings uniformly dark brown, apical portion of legs fuscous, antennae dark brown.

Genitalia as in fig. 1. Tenth tergite only slightly longer than wide, distal margin distinctly emarginate when viewed from lateral aspect, projected caudad to almost the same level as the basal segment of the clasper; when viewed dorsally, fig. 1A, mesal notch narrow and shallow. Basal segment of clasper gradually narrowed apically much narrower than *rotunda*, but with a similar finger-like projection of the apico-ventral corner; apical segment much deeper than long, distal margin sinuate. Ventral portion of tenth tergite is produced into a prominent complex structure consisting of a blunt dorsal process, a thin acute lateral piece and a large flat center

portion as shown in fig. 1B. Aedeagus consists of a heavily sclerotized central portion which is acute apically and projected dorsad when viewed laterally (very short and blunt in *rotunda*), ventro-apical corner produced into a long, slender acuminate point; from base arise a pair of extensile membranous arms, apex acute, covered with a dense brush of bristles, fig. 1C.

Female.—Length 11.5 mm. Identical in color and general appearance to male except more robust. Apex of abdomen drawn out into a cylindrical and unmodified tube.

Holotype. Male.—Glacier Park, Montana, Logan Pass, elevation 6660 feet, August 27, 1947, (C. P. Alexander).

Allotype. Female.—Same data as for holotype.

Paratypes.—Same data as for holotype, 8 males.

One paratype deposited in the collection of the University of Massachusetts.

***Agapetus montanus*, n. sp.**

On the basis of the peculiarly shaped ninth tergite, the dorsally narrowed short claspers and the wide, long tenth tergite this species can easily be separated from other described species.

Male.—Length 4–4.5 mm. Body and antennae dark brown, legs luteous, wings uniformly dark brown. Abdomen with the usual ovate organ on fifth segment, mesal process on sixth sternite short, blunt, directed ventrad.

Genitalia as in fig. 2. Lateral aspect of ninth segment with dorsum narrow, sternum wide, somewhat jug-shaped in appearance. Tenth tergite bilobed from base, each lateral lobe acute apically, gradually divergent; from lateral aspect base wide, gradually tapering to an acute, dark, sclerotized point directed caudo-dorsad, cerci relatively short, practically same width throughout, six long setae present, apex truncate. Claspers, from lateral view, short, narrowed dorsally, apico-ventral corner rounded; a short distance dorsad from ventral margin is a prominent heavily sclerotized acute short point directed dorso-mesad; approximately midway along dorsal margin is a heavily sclerotized acute short point directed mesad. Aedeagus consists of a long tubular structure originating in the seventh segment.

Female.—Length 4.5 mm. Very similar to male in general appearance and size. Fifth segment with a crescentric line, sixth segment bearing a short, blunt, ventral directed mesal process. Genitalia as in fig. 2A; dorsal portion, from lateral aspect, bluntly triangular, lateral portion projected caudad and slightly ventrad as

a large flap, ventral portion projecting caudad beyond any other part of segment, apical margin of sternum truncate from ventral aspect.

Holotype. Male.—Drummond, Montana, August 11, 1931, (R. H. Beamer).

Allotype. Female.—Same data as for holotype.

Paratype.—Same data as for holotype, 4 males.

Holotype, allotype and two paratypes deposited in the collection of the University of Kansas.

***Polycentropus smithae*, n. sp.**

This species bears closest resemblance to *iculus* Ross, but on the basis of the genitalia it can readily be differentiated from it or other members of the genus.

Male.—Length 7.5 mm. Wings light fuscous, legs and antennae a trifle lighter in color. Genitalia as in fig. 3. Ninth tergite membranous, irregular, caudal portion covered with minute setae. Ninth sternite only slightly wider than long, ventral margin produced into a very short triangular mesal projection, dorsal margin somewhat triangular when viewed from lateral aspect. Tenth tergite consists of a pair of prominent dorso-caudad directed hooks; when viewed from dorsal aspect, fig. 3A, base broad, apex acute, directed laterad; from either dorsal or lateral aspect a large spine is evident near apex and one near base, fig. 3. Cerci quite broad, orbicular. From the meso-ventral corner of the cerci there arises a pair of convergent, prominent, heavily sclerotized and ventrad directed hooks, which are partially covered by the claspers when seen from lateral aspect. Dorsad to this structure and extending to base of tenth tergite appears a flattened bell-shaped structure which is closely appressed and partially covers basal portion of aedeagus. Claspers about twice as wide as long, apex truncate; a large mesad directed tooth arises about midway along dorsal margin, fig. 3B; on the mesal surface arises a prominent triangular ridge. Aedeagus consists of a sinuate tubular dorsal part and a ventral part with apex divided into a pair of large dorsad directed lobes, apex covered with short spicules.

Holotype. Male.—Huntington Ravine, Mt. Washington, New Hampshire, elevation 5000 feet, July 17, 1942, (Marion Smith).

I take pleasure in naming this species in honor of Professor Marion E. Smith of the University of Massachusetts who collected this interesting species.

***Parapsyche extensa*, n. sp.**

This species is most closely related to *almota* Ross but differs markedly from it and other described species in the shape of the clasper, the ninth segment and the apex of the aedeagus.

Male.—Length 12 mm. Head and body black, antennae and legs dark brown. Wings gray with a scattering of light marks over entire wing. Genitalia as in fig. 4. Ninth segment rather wide throughout, dorsum produced into a prominent pair of slightly declivous humps. Tenth tergite divided into a pair of cylindrical apically blunt, convergent arms; from dorsal aspect very similar to *almota*; base of each with a patch of fairly long setae. Claspers short, about same width throughout, dorso-distal corner truncate; thumb-like process extended considerable distance caudad, almost one-half the length of clasper, dorsal and ventral margin sinuate, apex blunt, covered with short spicules. Aedeagus with wide base, middle portion cylindrical and greatly constricted, apex irregular, membranous, sclerotized hook blunt, as in fig. 4A.

Holotype. Male.—Lassen National Forest, California, King's Creek Meadows, elevation 7500 feet, July 6, 1947, (C. P. Alexander).

***Hydropsyche alvata*, n. sp.**

This species is closely related to *orris* Ross and *bidens* Ross, differing from these two species mainly in the apical portion of the apex of the aedeagus being short, blunt and wide.

Male.—Length 8–9 mm. Wings brownish, irrorate; similar in general appearance and structure to *bidens* and *orris*. Genitalia as in fig. 5. Ninth segment, tenth tergite and claspers very similar in appearance to that described and illustrated by Ross for *bidens* and *orris* except that the lateral lobes of the tenth tergite, from dorsal aspect, fig. 5B, is more rounded and the mesal incision is not so sharply V-shaped. Aedeagus with middle portion cylindrical, apical portion considerably widened; mesal plates relatively short and wide, apex blunt, fig. 5; mesal plates quite far apart from ventral aspect, fig. 5A; ventral cavity orbicular, mesal plates widest at apex, when seen from ventral aspect they are separated for about one-half their length.

Holotype. Male.—Jackson, Mississippi, April 24–30, 1946, (P. H. Harden).

Paratypes.—Mississippi. Same data as holotype except June 27, 1948 and March 3–10, 1946, 2 males. Illinois.—Nomence, June 24, 1936, at light, (Burks and Ayars). Michigan.—Paw Paw, July

18, 1944, (J. S. Ayars). The latter two paratypic males were loaned to the author by Dr. H. H. Ross so that they might be included in the type series and are deposited in the Illinois Natural History Survey collection.

***Cheumatopsyche virginica*, n. sp.**

This is an interesting species which is probably most closely related to *sordida* Hagen but differs radically from it and other described species. The peculiar tenth tergite and the apex of the aedeagus will serve for quick identification of this species.

Male.—Length 6 mm. Color of head and body light brown, appendages and wings straw color, wings with only a faint indication of an irrorate pattern. Genitalia as in fig. 6. Ninth segment with lateral portion moderately wide throughout, sternum extended caudad beyond any other portion of segment, dorsum reduced to a narrow strap bearing two tufts of long setae. Tenth tergite fairly long, dorsal portion semi-membranous; setiferous wart bulbous, directed dorso-laterad, very prominent from either dorsal or ventral view; apical lobes directed dorsad, apex bidentate, fig. 6, mesal portion rounded, does not extend dorsad of lobes. Claspers convergent, rather short; basal segment stocky, bulbous toward apex; apical segment short, triangular. Aedeagus with basal part large, suddenly constricted and curved ventro-caudad; from ventral aspect, fig. 6A, apex greatly enlarged, lateral lobes divergent, widely separated, apex of lobes triangular, distinct notch toward base.

Holotype. Male.—Dismal Swamp, Virginia, August 13, 1934, (R. H. Beamer).

Type deposited in the collection of the University of Kansas.

***Cheumatopsyche harwoodi*, n. sp.**

This species can be separated from *wrighti* Ross, its closest relative, by the triangular apical lobes of the tenth tergite, especially when seen from the caudad aspect, and by the distinct separation of the apical lobes from the main body of the tenth tergite when seen from the lateral aspect.

Male.—Length 7.5 mm. Genitalia as in fig. 7. Color of head and body dark brown, appendages a trifle lighter in color. Wings very dark brown, no indication of an irrorate pattern. Ninth segment with small lateral lobe, dorsum considerably narrowed and bearing a paired tuft of long setae. Tenth tergite, fig. 7, short, deep; lateral setiferous wart slender, fairly long, located near ventro-

caudad corner of tergite, (longer and more slender than in *wrighti* Ross). Apical lobes of tenth tergite very wide, directed dorsad only a short distance beyond remainder; from lateral aspect they appear sinuate; setae short except slightly longer along dorsal margin especially when seen from the caudal aspect, fig. 7A, from this view caudal surface concave, lobes triangular and contiguous; from lateral aspect, fig. 7, lobes distinctly separated their entire length from remainder of tergite. Claspers similar to *wrighti* Ross, slender, apex acute and curved mesad. Aedeagus with basal part large, bulbous, apical part cylindrical; apex short, blunt.

Female.—Length 7–8 mm. Size, color and general structure identical to male. Diagnostic characters are present in the shape of the clasper receptacle which is long and narrow throughout, fig. 7B.

Holotype. Male.—Gatlenburg, Tennessee, Roaring Fork, June 7, 1947, (Paul Harwood).

Allotype. Female.—Same data as for holotype.

Paratypes.—Same data as for holotype, 4 females.

This species is named in honor of the collector, Dr. Paul Harwood of Dr. Hess and Clark Co. who collected this species.

Radema comosa, n. sp.

This species is most closely related to *sorex* Ross, it can readily be separated from *sorex* by the slender cercus, the very short basal segment of the clasper, the triangularly shaped apical segment of the clasper and several other differences in the male genitalia.

EXPLANATION OF PLATE II

FIG. 1. *Rhyacophila ebria*, male genitalia, lateral aspect; 1A, dorsal aspect of tenth tergite; 1B, ventral portion of tenth tergite, lateral aspect; 1C, apex of aedeagus, lateral aspect.

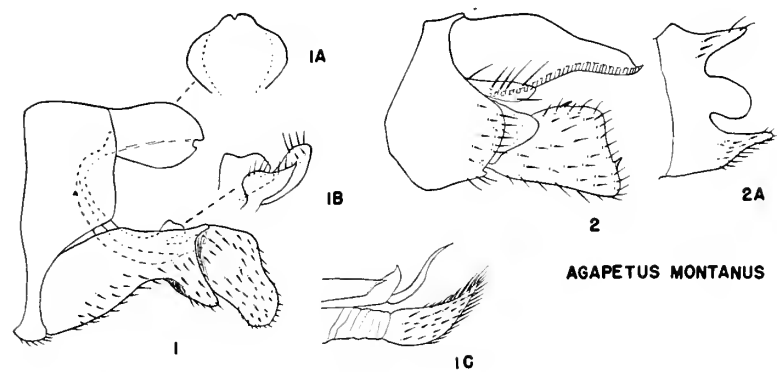
FIG. 2. *Agapetus montanus*, male genitalia, lateral aspect; 2A, female genitalia, lateral aspect.

FIG. 3. *Polycentropus smithae*, male genitalia, lateral aspect; 3A, tenth tergite, dorsal aspect; 3B, dorso-mesad aspect of hook of clasper.

FIG. 4. *Parapsyche extensa*, male genitalia, lateral aspect; 4A, apex of aedeagus, lateral aspect.

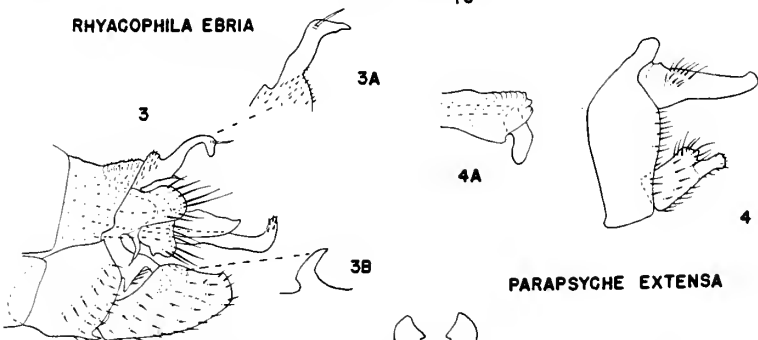
FIG. 5. *Hydropsyche alvata*, male genitalia, lateral aspect of aedeagus; 5A, aedeagus, ventral aspect; 5B, tenth tergite, dorsal aspect.

FIG. 6. *Cheumatopsyche virginica*, male genitalia, lateral aspect; 6A, apex of aedeagus, ventral aspect.



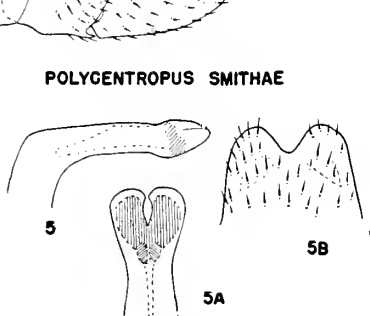
AGAPETUS MONTANUS

RHYACOPHILA EBRIA

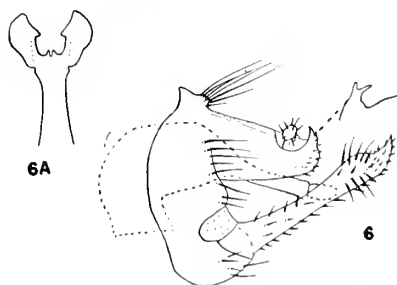


PARAPSYCHE EXTENSA

POLYCENTROPUS SMITHAE



HYDROPSYCHE ALVATA



CHEUMATOPSYCHE VIRGINICA

Male.—Length 8 mm. Head and body black, legs fuscous, antennae dark brown, wings dark brown with a scattering of short black setae. Spurs 1-2-2. Genitalia as in fig. 8. Ninth segment reduced on dorsum to about one-half size of sternum; arising from the dorsal portion and projecting cephalad is a thin flap-like process. When seen from the lateral aspect tenth tergite consists of the following processes: (1) a pair of dorsal acuminate appendages with base wide and extending slightly caudad beyond any other portion of genitalia, (2) a pair of prominent bilobed processes with dorsal arm long, slender, slightly widened toward apex and bearing five stout setae at apex; ventral arm one-half size of dorsal, slender throughout, bearing two stout setae apically, (3) a ventral pair of heavier widened processes, apex blunt, dorsal margin serrate; from dorsal aspect the most dorsad processes (1) are closely appressed, very slender and bear a few small fine laterad directed setae, fig. 8A, the ventral processes (3) are slightly divergent, apex sub-truncate, fig. 8B. Cerci short, slender, dorsal margin undulating, process bears a few fine setae. Clasper with basal segment short, stocky, bearing an abundance of long stout setae, seen from ventral aspect slightly wider than long; apical segment triangular, apex sub-acute, bearing a scattering of fine yellowish setae. Aedeagus with basal part arising from ventral part of eighth segment, curved dorso-caudad, dorsal arms divided from base into a pair of thin plate-like processes, acute apically, reaching caudad almost as far as dorsal

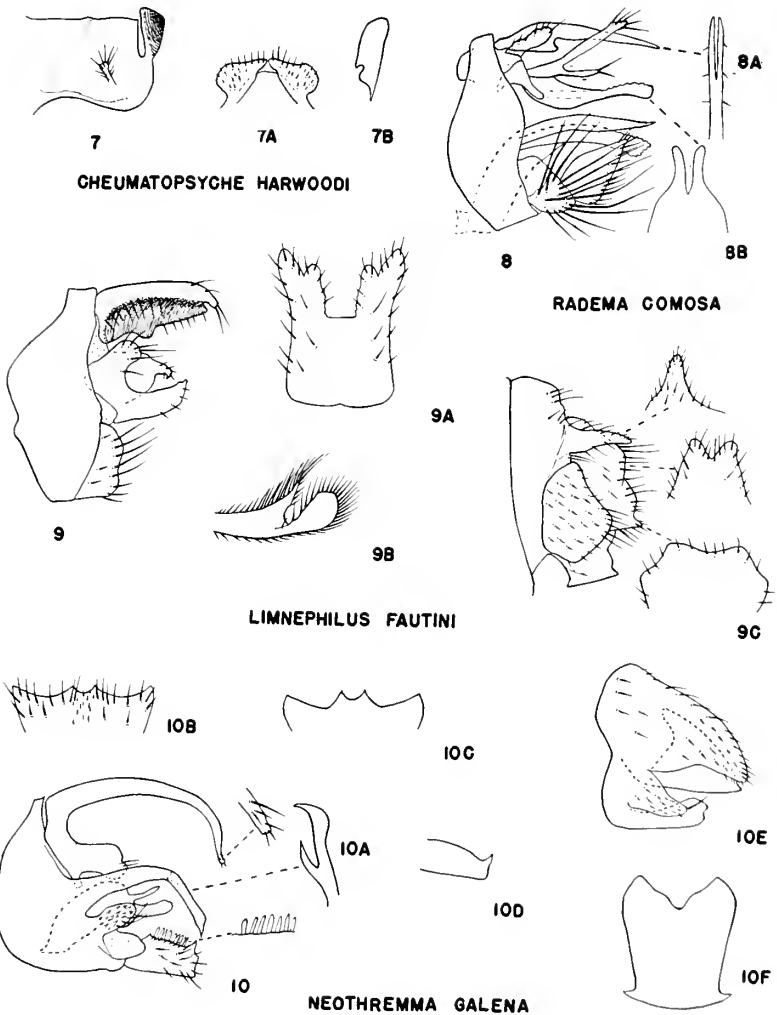
EXPLANATION OF PLATE III

FIG. 7. *Cheumatopsyche harwoodi*, male genitalia, lateral aspect of tenth tergite; 7A, apical lobes of tenth tergite, caudal aspect; 7B, female genitalia, clasper receptacle.

FIG. 8. *Radema comosa*, male genitalia, lateral aspect; 8A, dorsal portion of tenth tergite, dorsal aspect; 8B, ventral portion of tenth tergite, dorsal aspect.

FIG. 9. *Limnephilus fautini*, male genitalia, lateral aspect; 9A, cercus, dorsal aspect; 9B, apex of aedeagus, lateral aspect; 9C, female genitalia, lateral aspect.

FIG. 10. *Neothremma galena*, male genitalia, lateral aspect; 10A, apex, dorso-caudad view of lateral arm; 10B, clasper, ventral aspect; 10C, clasper, ventral aspect of paratype; 10D, clasper, lateral aspect of paratype; 10E, female genitalia, lateral aspect; 10F, female genitalia, ventral aspect of sternum.



arm of tenth tergite; main structure cylindrical, apical margin minutely scalloped.

Holotype. Male.—Louder Ranger Station, Dixie National Forest, near Cedar Breaks, Utah, elevation 10,200 feet, June 27, 1947, (C. P. Alexander).

***Limnephilus fautini*, n. sp.**

This species can easily be separated from its closest relative *brevipennis* Banks by its smaller darker appearance (in *brevipennis* the males range from 9.5–14 mm.), by the wider clasper, the much more deeply incised tenth tergite and the apically bilobed condition of the cercus.

Male.—Length 9.5 mm. Color of head and body black, appendages and antennae brown. Wings dark brown, an abundance of light yellowish spots of various shapes and sizes scattered over wing, entire surface covered with black erect fairly long setae. Front basitarsus longer than second tarsal segment and with a slender yellow spur. Eighth tergite without any modifications. Genitalia as in fig. 9. Ninth segment with dorsum and sternum about same width, lateral portion practically three and one-half times width of dorsum. Claspers reduced, but much more prominent than in *brevipennis*, nearly same width throughout and bearing several long black setae along distal margin. Cercus, from lateral aspect, massive, directed caudad in a nearly horizontal plane, latero-ventral surface deeply excavated, apex bilobed, each blunt, ventral margin of each serrate; from dorsal aspect, fig. 9A, fused basally, apex separated into a pair of mesal labes, and a larger sub-acute pair of lateral lobes. Tenth tergite appears from lateral aspect to be divided, lateral portion deeply incised forming a short blunt dorsal lobe and a long, caudad directed, apically acute ventral lobe; mesal part consists of two divergent lobes, base very wide, caudal portion slender, apex truncate, gradually curved ventrad. Aedeagus with lateral arms sinuate, apex forked, most cephalad branch slender and triangular, bearing a dense brush of brownish setae, most caudal branch semicircular, bearing a fringe of yellowish setae, fig. 9B.

Female.—Length 9.5–10 mm. Essentially similar in general appearance, size and color to male. Genitalia as in fig. 9C. Cercus triangular from dorsal view. Tenth tergite tubular with a V-shaped incision along apical margin of dorsal surface, separation complete although faintly marked, apical margin of ventral surface convex, most of surface of tergite bearing stout black setae.

Holotype. Male.—Albany Co., Wyoming, Snowy Range Mountains, Medicine Bow National Forest, Libby Flats, elevation 10,800 feet, July 16, 1948, (Reed W. Fautin).

Allotype. Female.—Same data as for holotype.

Paratype.—Same data as for holotype, 1 female.

I take pleasure in naming this species in honor of Dr. Reed Fautin of the University of Wyoming who collected this interesting species.

***Neothremma galena*, n. sp.**

This species, the second described in the genus, can readily be separated from *alicea* Banks by the apex of the tenth tergite which is not divided as it is in *alicea*, and the lateral projection of the ninth segment which is divided nearly midway rather than at the apex. In addition there are several other genitalic differences.

Male.—Length 6.5–7.5 mm. Head and body dark brown, legs luteous, wings brownish throughout, about same shade of color as antennae. Spurs 1–3–4. Male palpi recurved, third segment reaching dorsad to a level about one-half length of eye, dorsal and mesal surface with a fringe of long setae. Genitalia as in fig. 10. Ninth segment with dorsum reduced to a narrow strap, lateral portion wide, sternum about five times width of dorsum, projected caudad beyond any other part of segment. Tenth tergite bilobed from base, each arm long, antennuated, distal portion curved ventrad, apex sub-acute, bearing six setae, fig. 10; ventral part of tergite divided into a pair of rather broad almost contiguous plates extending caudad a short distance over aedeagus. Caudal margin of the ninth segment produced caudad as a pair of cylindrical arms, gradually convergent but apices not contiguous, distally bent ventrad, at this point a short acute arm, fig. 10A, is produced mesad. Just ventrad to this arm arise the cerci, short, slender and covered with flat scale-like spicules. Claspers fused along meson, from ventral aspect emargination shallow, as in holotype, fig. 10B, degree of indentation is variable, as shown in paratypes, fig. 10C; from lateral aspect clasper short, about same width throughout, apex truncate, dorso-caudal corner dentate, dorsal margin with a dense fringe of lightly sclerotized, slender, scale-like setae, fig. 10, apex of clasper varies somewhat, to degree shown in paratypes, Fig. 10D. Aedeagus short, arising in ninth segment, divided into a large ventral plate and a horn-like dorsal lobe.

Female.—Length 6.5 mm. Essentially similar to male except for usual antigenetic differences. Genitalia as in fig. 10E–F. Tenth

tergite long, gradually tapering caudo-ventrad, apex blunt. Cerci subtriangular. Sternum, from ventral aspect, fig. 10F, fused along meson, incision V-shaped.

Holotype. Male.—Olympia National Park, Washington, Boulder Lake Trail, elevation 3500 feet, August 5, 1947, (C. P. Alexander).

Allotype. Female.—Same data as for holotype.

Paratypes.—Mt. Baker, Washington, Galena Camp, elevation 4000 feet, August 10–14, 1947, (C. P. Alexander), 4 males.

One male paratype deposited in the collection of the University of Massachusetts.

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NOTICE.

The Brooklyn Entomological Society is pleased to announce that Dr. J. Bequaert of the Museum of Comparative Zoology, Harvard University has accepted the editorship of **ENTOMOLOGICA AMERICANA**. All communications concerning this journal should be addressed to Dr. J. Bequaert, Museum of Comparative Zoology, Cambridge 38, Massachusetts.

A NEW GENUS OF TEPHRITIDAE NEAR XANTHOMYIA. (DIPTERA)

BENSON F. QUISENBERRY

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A study of the genus *Tephritis* Latreille has revealed that a number of species which have previously been referred here vary widely from the genotype. This paper is intended to deal with one of these, *geminata* Loew.

This study of specimens of *geminata* was made possible by Dr. Alan Stone, of the Division of Insect Identification, Bureau of Entomology and Plant Quarantine, to whom special thanks are extended.

Jamesomyia, new genus.

Head (Figs. A, B,) higher than long, wider than high; width of vertex across median ocellus slightly more than half maximum width of eye; frons flattened, tapering anteriorly; parafrontals and center of frontale with short, suberect, white setae; eyes ovate; face short, receding slightly; antennal fovea moderately deep; oral cavity rounded, drawn up anteriorly, projecting forward conspicuously; cheeks rather narrow, approximately width of third antennal segment; antennae not reaching to oral margin, third segment subacute at upper anterior angle; arista short pubescent; palpi flattened, rather broad basally, becoming narrower apically, convex ventrally; proboscis short, rather stout; four pairs subequal lower fronto-orbitals; two pairs upper fronto-orbitals; set well in towards center of frons, the anterior pair usually in a transverse line with posterior pair of lower fronto-orbitals; one pair strong ocellars; one pair inner verticals; one pair outer verticals which are nearly as long as inner pair; postverticals stout; postocular cilia stout, interspersed with shorter dark setae; genal bristle well developed.

Thorax: Two pair dorsocentrals, the anterior pair about in line with supraalars, the posterior pair slightly ahead of a transverse line through intraalars; one pair humerals; one pair presuturals; one pair supraalars; one pair postalars; one pair intraalars; two pair notopleurals; three to four pairs of mesopleurals, variable; one pair pteropleurals, occasionally a second weaker bristle on one or both sides; one pair sternopleurals; two pairs marginal scutellars, one pair at apex, one pair at base; scutellum slightly swollen basally.

Legs: Front femora each with a row of strong setae ventrally

and shorter, scattered ones, on outer side; hind femora each with a few short setae at apex dorsally; middle tibiae each with one apical spur; hind tibiae each with a fringe of short setae on outer side.

Wings (Fig. E): Two-fifths as wide as long; anterior and posterior crossveins oblique; anal cell drawn out conspicuously on sixth vein; first and third veins setose.

Abdomen: Broader than thorax; ovipositor sheath short, only slightly longer than width at base, distinctly swollen at base dorsally; ovipositor very slender and delicate; male genitalia (Figs. C, D) very small; claspers rather stout; aedeagus slender, apical portion elongate, rather heavily sclerotized.

Genotype.—*Trypeta geminata* Loew.

Jamesomyia will trace to *Xanthomyia* Phillips, in Curran's key¹, but that genus differs, in addition to other characters, in having two pairs of lower frontoorbitals; a very weak, inconspicuous pair of outer vertexes; only one pair of mesopleurals; costal spines strong, over twice as long as width of costa; wings very broad, about three-fourths as wide as long; and in not having the claspers of the male genitalia modified into the abruptly narrowed, less heavily sclerotized apical portion, as shown in the figure.

I take pleasure in naming this genus after Dr. M. T. James.

***Jamesomyia geminata* (Loew).**

Trypeta geminata Loew, Berl. Ent. Zeit., 6: 220, 1862. (Cent. 2, no. 75).

Trypeta (*Tephritis*) *geminata* Loew, Smithsn. Misc. Collect., 11 (256): 298, pl. 11, fig. 1, 1873.

Euribia geminata (Loew): Phillips, Jour. N. Y. Ent. Soc., 31 (3): 150, pl. 9, fig. 62, 1923.

Male and female.—Head: Mainly pale yellow, subshining; a large spot on frontale, extending from lunula to bases of anterior pair of upper frontoorbitals, yellow; upper frontoorbitals set in narrow, whitish, shining calli that extend anteriorly on each side from lateral corners of vertex; a large spot on upper half of occiput that sends forth two short arms on either side, one to outer vertical bristle the other to lower posterior corner of eye, a small spot on extreme upper area of parafacials, and ocellar triangle, dark brown; lunula and face whitish, latter sometimes dark on upper half; first and second antennal segments yellow, former with fine, pale setae,

¹ Curran, C. H., 1934. The families and genera of North American Diptera. New York, Ballou Press, 289.

latter with brownish setae, a single median one being somewhat elongate and conspicuous, third segment more brownish yellow; arista mainly brown, basal one-fourth yellowish; palpi and proboscis yellowish, former with dark brown setae, latter with rather long, pale hair; frontoorbitals, ocellars, and inner and outer verticals varying from yellowish to yellowish brown; postverticals and post-ocular cilia whitish; genal bristle and scattered shorter setae on cheeks brown, that on lower occiput pale yellowish.

Thorax: Mesonotum 1.68–1.82 mm. long; subshining, brown except for the following yellowish areas: humeri and adjoining stripe extending posteriorly across upper half of mesopleura to and including wing base, a spot on each side of the scutum lying immediately behind intraalars and reaching to scutoscuteellar suture, upper one-third of hypopleura, and all of scutellum except basal corners and a narrow band adjacent to scutoscuteellar suture; a small spot on either side directly below postalar bristle is dark brown, nearly black; brownish areas, except extreme anterior portion of prescutum, covered with a very fine, whitish microsetae which is denser on notum; notum with rather dense, short, whitish setae, which are longest on humeri; a brown spot on either side on transverse suture, directly ahead of dorsocentrals, is bare; a few black setae form an anterior patch, near humeri, which extends diagonally backward onto anterior portion of notopleura; scutellum nearly bare; pleural regions, except notopleura which are bare, with scattered white setae which are longer than that on notum, densest on propleura and extreme ventral portion of sternopleura, that on mesopleura intermixed with some brown; bristles on notum set in small brown spots.

Legs: Coxae, except at apices, femora, except apices of front and middle pairs, brown, all other areas yellowish; setae on femora brown, that on remainder of legs yellowish.

Wings: (Fig. E): Pattern dark brown, lighter towards posterior margin; spots and marginal indentions milky white; halteres yellow.

Abdomen: Subshining, tergites one and two yellowish, except for a pair of spots and the lateral margins which are brown, remaining tergites brown except for third which has a yellowish spot on either side on anterior margin; covered with a mixture of very fine whitish and light brownish pollen, which is densest on apical three tergites; with rather dense, short, semiappressed, whitish setae, latter restricted to brownish areas of posterior four tergites, longest on lateral margins and hind margin of apical tergite; sternum yellowish, with fine white and brown setae, latter restricted to posterior two

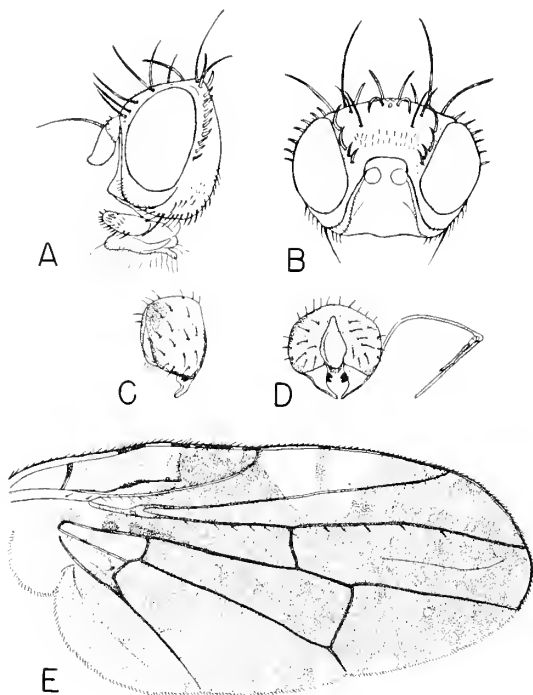
sternites; ovipositor sheath shining brown, an inconspicuous dorsal spot and underside somewhat lighter; covered with a fine brownish pubescence; male claspers about 0.39 mm. long, brown, tips somewhat lighter, with short brownish setae.

Type locality.—Pennsylvania.

Type in the Naturhistorisches Museum at Vienna, Austria.

Food plant.—Unknown.

Distribution.—Previously recorded from Pennsylvania, type series, and New Jersey. The following specimens have been examined in this study.—WEST VIRGINIA: French Creek (F. E. Brooks), one male. NEW JERSEY: Riverton (C. T. Greene), one female. VIRGINIA: Falls Church, July 13, 1913 (Fred K. Knab), one female.



EXPLANATION OF FIGURE

Jamesomyia geminata (Loew). A. head (side view); B. head (front view); C. male claspers (side view); D. male claspers (anal view); E. wing of female.

ORIUS FEEDING NOTES

GEORGE F. KNOWLTON

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A mature *Orius tristicolor* (White) was observed to be feeding on an *Aphis gossypii* Glover nymph, on the underside of a watermelon leaf which was heavily infested with this aphid, at Green River, Utah, July 26, 1932. At Castle Cliffs, Washington County, Utah, a *tristicolor* was found while feeding on a nymphal *Macrosiphum zerozalphum* Knt. on *Erodium cicutarium*, April 24, 1942. *Orius insidiosus* (Say) comprised approximately 85 percent and *O. tristicolor* the balance of the adult minute pirate bugs in sugar-beet seed fields at St. George, Utah, May 18, 1944. One *insidiosus* was feeding on a nymphal *Myzus persicae* (Sulzer) green peach aphid, which was numerous on a seed beet plant. Insect net sweepings showed adults of both these species of predators and their nymphs to be numerous and feeding on western flower thrips, which were especially abundant on the beets. The predacious bugs often moved about while thrips were impaled on the stylets, at the ends of the beaks. An *O. tristicolor* was observed to have captured and to be feeding on a *Chaitophorus viminalis* Monell aphid on *Salix* at Hamilton, Montana, August 7, 1944, and another on a nymphal *Phorodon humuli* Schrank on a hop leaf at Corvallis, Oregon, August 23, 1944. A study of onion thrips injury to seed onion heads was made at Moab, Utah, June 13, 1945. This revealed a damaging population of approximately 400 to 1200 thrips per heavily infested blossoming onion head. Both *O. tristicolor* and *O. insidiosus* and their nymphs were numerous and feeding actively on thrips. From three to eight adult predators besides the nymphs, were shaken from individual flowering onion heads. *O. tristicolor* was numerous and feeding on the thrips which in great abundance were damaging raspberry fruits and foliage at Alpine, Utah, July 1, 1947. *O. tristicolor* also fed on a nymph of *Myzus persicae* at Moab, Utah, April 8, 1947; in this instance aphids were injuring foliage of "blood plum." Adults and nymphs of this predacious bug were numerous in aphid-curved plum leaves infested with this and other species of aphids. At Enterprise, Utah, a *tristicolor* nymph was feeding on an *Odontothrips loti* (Hal.), in the insect net, following sweeps made on *Artemisia tridentata*, July 16, 1947. Thrips of this species and also *Sericothrips variabilis* (Beach) (Det. Dr. S. F. Bailey) were numerous on the sage at

this time. Insect net sweeps made at Lakepoint, Utah, July 22, 1947, showed western flour thrips, *Frankliniella moultoni* Hood, to be extremely numerous, with smaller numbers of *Thrips tabaci* Lind. and *Acolothrips fasciatus* (L.). Thousands of thrips and dozens of adult and nymphal *O. tristicolor* were swept up in a clean, new insect net bag. The predacious habit of this minute pirate bug was especially noticeable when three adult and nine nymphal predators were observed to each have captured and to be feeding on a thrips, mostly *Frankliniella moultoni*. When the *tristicolor* tried to capture thrips on the smooth new cloth, about three out of four thrips escaped. However, thrips were readily captured when the tiny predators invaded thrips-packed folds of the net. After a few minutes of observation, twenty three of the small predators were counted on the net bag, each with a thrips impaled at the end of the beak; included were all three species of thrips listed above. While working during summer and making net-sweeps in numerous alfalfa and other fields, the writer often has introduced many thrips into his car. An *O. tristicolor* was found to be feeding on a *Frankliniella minuta* (Moulton), on the rear door car-window, where approximately 200 thrips were present, most of which were western flower thrips. Several observations showed this predator to feed on the small thrips for at least ten minutes. An hour later the predator had captured a winged *Frankliniella moultoni*, on which it fed for some time. At Green River, Utah, on September 3, 1947, both *O. tristicolor* and *O. insidiosus* adults and nymphs were present and fed actively on western flower thrips which were present in great numbers on goldenrod. Examination of a mite-injured corn field at Moab, on this same date, revealed an adult *O. insidiosus* and some tiny blackish ladybird beetles to be feeding on the common spider mite present on the corn leaves. *O. insidiosus* was found to be feeding on western flower thrips in flowers of pinto beans in large fields west of Monticello, Utah, September 4, 1948. One of these predators walked around on the writer's hand for approximately one minute, carrying its tiny prey. An *Orius* nymph "fed" on the skin of the first knuckle of my left fore-finger for 3.5 minutes, not moving until disturbed, then it tried to "feed" again. This nymph came from thrips-infested bean blossom, at Cedar Point, west of Monticello, on the above date. The slight irritation produced by this little bug reminded the writer of numerous occasions during late summer, when thrips, largely western flower thrips, had irritated skin of neck, arms and hands, following the collections of great numbers of thrips from blossoming *Chry-*

sothamnus plants, particularly in San Juan and Grand Counties of Utah. On occasion, *Orius* nymphs also had been observed to attack the skin of forearms and hands, usually at a time when the skin was moist with perspiration. An adult *tristicolor* was observed to be the cause of irritation on my left-hand as I drove thru Erda, Utah, August 19, 1947. This and subsequent attempts to "feed," usually for only five to twenty seconds at a time, occurred at several places on the back of hand and wrist, each time with perceptible irritation.

While examining celery in a field south of Salt Lake City, an adult *O. tristicolor* was found while feeding on a small winged aphid, *Cavariella aegopodii* Scopoli. Studies made with *O. tristicolor* as a predator of the pea aphid have indicated a high mortality of large pea aphids, after they had been fed on but not killed during the feeding. This little predator often has been abundant in alfalfa fields throughout Utah during much of the summer where thrips and pea aphids were numerous.

BOOK NOTE.

A General Textbook of Entomology. By A. D. Imms. xii-726 pp., 624 figures. 6 x 9 ins., cloth bound. 1949. E. P. Dutton & Co., Inc., New York, N. Y.

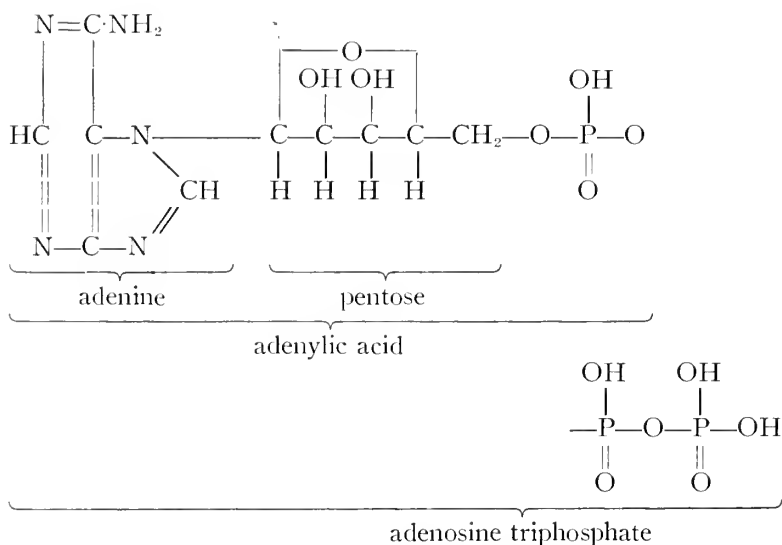
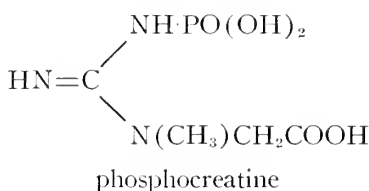
A *Seventh Revised Edition* of this textbook is scheduled to appear on May 10, 1949. It covers the anatomy, embryology, development and metamorphosis of insects of all parts of the world. The peculiarities of structure and function of the various families and orders are treated very completely. Typical life histories are included for many of the groups. GEORGE S. TULLOCH, Merrick, New York.

ADENOSINE TRIPHOSPHATE FROM INSECTS

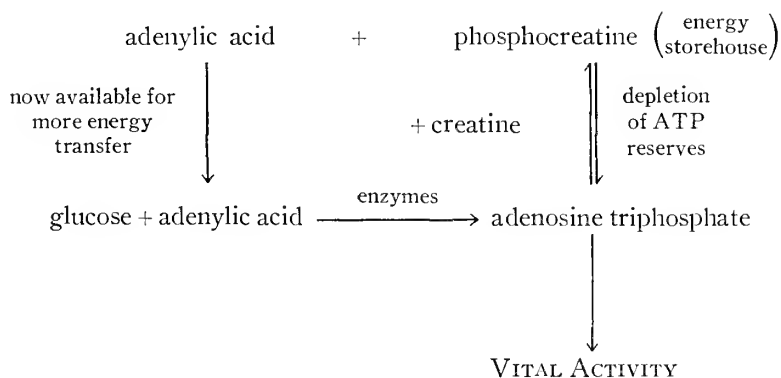
By HARRY G. ALBAUM, Brooklyn College, Brooklyn, N. Y.

In recent years the attention of the biochemist has become focussed on the way in which light energy from the sun, converted by the green plant into carbohydrate, is made available for vital function in living tissue. It is now generally established that this carbohydrate (usually in the form of glucose), does not make its energy directly available for cell function, but rather transfers its energy in small parcels, through the activity of enzymes, to specialized molecules which act as the immediate energy donors for reactions of all kinds.

Of several such compounds that are known, two are of special interest: phosphocreatine and adenosine triphosphate (ATP); the formulae of these are shown below:



The energy originally resident in the glucose molecule appears in these compounds in the N—P bond of phosphocreatine and in the P—O—P bonds of adenosine triphosphate (high energy phosphate bonds). Adenosine triphosphate is the immediate recipient of the glucose energy. Therefore, one would expect that in the organism the quantity of adenosine triphosphate which could be formed would be limited by the quantity of adenylic acid (see above formula) which can act as an energy acceptor. The organism, however, has another mechanism for increasing its energy stores. As soon as the adenylic acid has been "saturated" with high energy phosphate bonds, these are temporarily transferred to creatine to form phosphocreatine; more energy can now be taken up by the "adenylic acid system." When energy must be used for vital activity, adenosine triphosphate acts as the immediate donor. As soon as its level falls, it is replenished from the phosphocreatine reservoir. These reactions are shown in a general way in the following equation:



Phosphocreatine and adenosine triphosphate are found in all vertebrates. In invertebrates, phosphocreatine is replaced by a related compound, phosphoarginine. The kind of adenosine triphosphate which is present in invertebrates, however, has not yet been extensively investigated. The remainder of the present paper concerns itself with the adenosine triphosphate of insects.

We have succeeded in isolating adenosine triphosphate from adults of *Drosophila melanogaster* Meign (Diptera). Since this compound is very unstable and breaks down rapidly on the death of the animal, the isolation must be carried out on freshly killed animals and all manipulations must be carried out in the cold.

The procedure employed in the isolation was essentially that of Needham (1) with slight modification. A typical run is outlined below: 11.5 g. of ether-anesthetized *Drosophila melanogaster* were homogenized in approximately 10 ml. of iced 10% trichloroacetic acid with a motor driven glass homogenizer, and the protein removed by centrifugation. To the orange-pigmented supernatant fluid was added an equal volume of cold 95% ethyl alcohol; the precipitated glycogen was centrifuged out. To the supernatant were added 3 ml. of 25% barium acetate and the pH adjusted to 7.0 with 30% NaOH. After 0.5 hour in the cold the barium precipitate was collected and washed twice with cold 95% alcohol. (This removed most of the orange pigment.) The barium precipitate was then suspended in water, centrifuged once more and the supernatant discarded. The barium-insoluble precipitate remaining was then treated according to the method of Needham (1) for the isolation of ATP from mammalian muscle, and 20 mg. of a grayish barium salt were obtained.

The barium salt was assayed for inorganic phosphorus, labile phosphorus (phosphorus hydrolyzed in 7 minutes at 100° C. in N HCl) and total phosphorus, according to the method of Fiske and SubbaRow (2). Color development curves for pentose were run according to the method of Albaum and Umbreit (3). Adenine was assayed spectrophotometrically.

On the assumption that the compound isolated was barium adenosine triphosphate (M.W. 853), the purity based on organic phosphorus was 78%. The molar ratio of labile phosphorus: total phosphorus: pentose: adenine was 1.90: 3.00: 1.00: 1.04.

The adenosine triphosphate isolated from *Drosophila* appears to be identical with that obtained from vertebrate muscle. This identity has been established on the basis of the molar concentration of adenine: ribose: phosphorus, as well as on the basis of physiological activity.

As indicated above, adenosine triphosphate is isolated from the barium insoluble precipitate. If such a precipitate is prepared from other organisms, where not much material is available, it is possible by simply analyzing this precipitate to qualitatively demonstrate the presence of this compound (phosphorus, adenine, and ribose content). This kind of experiment has been done on the following insects:

COLEOPTERA

Tribolium confusum Jacq. Duz., adults.

Tenebrio molitor L., larvae.

ISOPTERA

Reticulitermes flavipes Kol., workers

ORTHOPTERA

Paratenodera sinensis Sauss., nymphs

Adenosine triphosphate appears to be present in all of these, and

on the basis of the analytical data resembles that isolated from *Drosophila melanogaster*.

SUMMARY

A procedure is described for isolating adenosine triphosphate from insects. This compound has been isolated from *Drosophila melanogaster* and its presence demonstrated in four other insects. On the basis of analytical and physiological data, the isolated compound is identical with that obtained from vertebrate tissue.

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SARCOPHAGIDAE (DIPTERA) FROM THE GREAT SMOKY MOUNTAINS NATIONAL PARK.

By GEORGE C. STEYSKAL, Grosse Ile, Michigan.

The following species were collected by the writer and Robert R. Dreisbach, of Midland, Michigan, and are presented as a small addition to the woefully small fund of knowledge available concerning the distribution of the Diptera of the southeastern United States. The June dates are in 1946, the August ones in 1947. The localities are in the Tennessee part of the park, except Andrews Bald (mountain), Spence Field (on Thunderhead Mountain), and Smokemont, which are in North Carolina.

Eumacronychia nigricornis Allen—Headquarters, June 10.

Harbeckia tessellata Aldrich—Ramsey Cascades, June 12.

Metopia campestris Fallen—Cades Cove, August 13.

M. leucocephala Rossi—Headquarters.

Pachyophthalmus distortus Allen—Cades Cove, June 13.

Sarcophaga assidua Walker—Chimneys Camp, Aug. 11; Cades Cove, June 13.

S. bisetosa Parker—Cherokee Orchard, June 14.

S. cimbicis Townsend—Cades Cove, June 13; Clingman's Dome, Aug. 14.

S. ciugarus Aldrich—Chimneys Camp, June 11, Aug. 11; Cades Cove, Aug. 12; Newfound Gap, Aug. 15.

S. fulvipes Macq. (black-legged form)—Chimneys Camp, June 11; Ramsey Cascades, June 12.

S. latisterna Parker—Chimneys Camp, June 11; Cades Cove; Spence Field, Aug. 13.

S. lherminieri R.-D.—Spence Field, Aug. 13.

S. misera sarracenioides Aldrich—Andrews Bald, June 16; Cades Cove, June 13; Chimneys Camp, June 11; Elkmont, June 15.

S. rapax Walker—Chimneys Camp; Clingman's Dome; Headquarters, Newfound Gap; Smokemont, Aug.; Spence Field, Aug. 13.

S. scoparia nearctica Parker—Chimneys Camp, Aug. 11.

S. stimulans Walker—Spence Field, Aug. 13.

Senotainia trilineata Walker—Chimneys Camp; Headquarters.

SOME NEW DICYRTOMA AND KEY TO KNOWN SPECIES OF THE UNITED STATES. (COLLEMBOLA, SMINTHURIDAE).

By D. L. WRAY, Raleigh, N. C.

Some interesting forms of *Dicyrtoma* have been found during the course of collecting in North Carolina and it is the purpose of this paper to describe these new forms and to point out some of the structural complexities involved among the species of this genus described so far from the United States.

Three new species and one new variety are described, namely, *Dicyrtoma ochreous*, *D. mithra*, *D. curvilineata*, and *D. hageni* variety *vinalis*. Other species in the key and discussed are: *D. hageni* Folsom, *D. frontalis* Banks, and *D. quadangularis* Mills.

Genus *Dicyrtoma* Bourlet, 1843
Papirius Lubbock, 1862, ad p.

This genus is separated from the other genera of the subfamily Dicyrtominae Börner by the claw being without a tunica, dentes possessing large serrate setae dorsally, and the 3rd and 4th antennal segments not subsegmented.

In making a key the structural similarities of the forms were soon recognized. In the mucro there is only a slight difference in the number of teeth of the serrated margins. There is a difference in the subapical filament of the unguiculus, whether apically knobbed or not, and in length. There is some difference in the dentation of the unguis and in arrangement of the setae of the dentes. Some difference was noted in the subanal female appendage. Otherwise, the color pattern and size are used as separable characters.

KEY TO SPECIES OF DICYRTOMA KNOWN FROM THE UNITED STATES.

1. Subapical bristle of unguiculus distinctly knobbed at apex, extending beyond end of unguis; unguis with one distinct tooth on its inner margin 2
 - Subapical bristle of unguiculus not knobbed at apex, shorter than above, reaching only to end of unguis; unguis with two distinct teeth on its inner margin 6
2. Color pattern in the form of longitudinal stripes and spots; length 0.75 mm. *curvilineata* n. sp.
 - Color pattern not as above 3

3. Head entirely white; abdomen blackish-purple with posterior dorsal pattern of yellowish-brown; length up to 1.5 mm.
hageni Folsom
Head pigmented; abdomen with different color pattern 4
4. Head pigmented only around eye-spots or vertex.
hageni var. *vinalis* n. var.
Head pigmented entirely or banded 5
5. Head banded with 2 broad, brownish-black bands; length up to 1.2 mm. *frontalis* Banks
Head not banded, but pigmented orange-ochreous all over; abdomen orange-ochreous all over with pearly spots dorsally and laterally; length 1.5 mm. *ochreous* n. sp.
6. Length 1.6 mm.; dens with 3 appressed ventral hairs distally; antennae white, but for pigment near elbow; head deep blue but for oral region; body blue with irregularly diamond-shaped white area dorsally *quadangularis* Mills
Length 1.0 mm.; dens with 4 appressed ventral hairs distally; head and body reddish-orange, dorsum lighter, and color pattern a mosaic of light and dark colored round areas and spots *mithra* n. sp.

Dicyrtoma ochreous, n. sp. (Figs. 1-7)

Length up to 1.5 mm. General color orange-yellow with white or pearly spots in the following color pattern (Fig. 1). Head yellow with a large white spot around eye-spot and smaller ones on cheeks; antennae light yellow at base grading to dark brown-purplish at apex; body orange-yellow, darker dorsally and posteriorly on abdomen, with 4 to 6 white spots dorsally and one to two laterally; several small spots ventrally on body; legs orange-yellow with a white spot on both posterior coxae and femur; furcula light yellow basally becoming pale apically; three large white spots ventrally at base of furcula.

Eyes 8 on each side on a black eye-spot (Fig. 6). Antennae longer than head or as 57:35. Relative lengths of antennal segments as: 4:23:22:8. Ant. 3 and 4 not subsegmented and with definite whorls of hairs. Unguis (Fig. 4 and 5) without a tunica, rather straight, pointed, with an inner tooth one-fourth the distance from the apex, and a pair of distal outer teeth. Unguiculus (Fig. 4 and 5) with an inner basal tooth and a long strongly knobbed subapical filament reaching beyond the apex of the unguis. Tenent hairs absent. Dentes three times length of mucro, with two rows of dorsal setae; with the inner row of 4 outstanding long spines, and

an outer row of 6 serrate setae, one simple spine basally on lateral margin; 4 appressed ventral spines distally. Mucro (Fig. 2) with coarse serrate teeth on both edges. Subanal appendages of female (Fig. 3) curving, spinelike.

Heavy, short spinelike hairs on front of head and vertex. A few short simple reclinate hairs on front of body, dorsum of abdomen in the specimens examined nearly naked. Posterior part of abdomen with short spinelike hairs similar to head. Ano-genital segment with longer and more spinelike setae. Legs with short hairs basally becoming longer and more spinelike on tibio-tarsi. Posterior tibio-tarsi with 2 heavy pinnate bristles as in *Ptenothrix unicolor*. Body integument finely tuberculate. Corpus of tenaculum with one short apical bristle. At least 3 postero-lateral bothriotrichia situated as in figure 7.

Specimens taken in leaf mould from a hardwood forest at the edge of Lake Raleigh, Raleigh, North Carolina, October 29, 1943, D. L. Wray and C. S. Brimley. Cotypes in N. C. D. A. Insect Collection.

Dicyrtoma mithra, n. sp. (Figs. 8-18)

Length up to 1 mm. General color variable in different specimens, from yellowish to reddish-orange to purplish. Antennae light purple basally, deep purple distally. Head reddish-orange to light purplish, with black eyespots and two blackish, ocelli-like spots on front between bases of antennae. Body reddish-orange to purplish with the dorsum lighter and with an indication of an anterior dorsal light streak in some darker specimens. The color pattern (Fig. 8, which is the darker form) on dorsum and sides of body in the form of a mosaic, with an intermingling of dark purplish and light orange round areas and spots. Legs orange to light purplish. Furcula light orange-purplish basally and pale distally.

Eyes 8 on each side on a black eyespot (Fig. 9). Antennae longer than head or as: 31:25. Relative lengths of the antennal segments as: 3:11:13:5. Ant. 3 and 4 not subsegmented; ant. 3 with at least 4 sensory protuberances, each with a single straight sense spine; ant. 4 with about 6 whorls of hairs of somewhat reclinate hairs. Unguis (Fig. 11 and 12) with two teeth on the inner margin and one on outer margin. Unguiculus (Figs. 11 and 12) lanceolate with a basal spine and an apical unknobbed bristle extending to apex of unguis. Tenent hairs absent. Dentes to mucro as 13:4; with 2 dorsal rows of mostly serrate setae, inner row of 4 simple, long, setae, the distal and proximal ones being the

longest; outer row consisting of 6 serrate spines and an extra one near base of mucro; one simple spine basally on lateral margin; 4 appressed ventral hairs on distal half (Fig. 10).

Mucro (Fig. 10) with coarse serrate teeth on both edges, cleft apically. Subanal appendages of female (Fig. 15) only slightly curving, spinelike.

Heavy, short, spinelike hairs on front and vertex of head; short, recurving hairs anteriorly on dorsum of body, becoming short stout, spinelike on posterior fourth of dorsum; anal papillae with stout, straight, spinelike hairs, and longer, curving slender hairs. Body integument finely tuberculate. Three postero-lateral bothriotrichia situated as in figure 18.

Taken in hardwood forest leaf mould at edge of Lake Raleigh, Raleigh, North Carolina, January 9 and 26, 1943, D. L. Wray and C. S. Brinley 2 specimens; 30 specimens taken at same place, January 9, 1948, DLW. Cotypes in NCDA Insect Collection.

Dicyrtoma curvilineata n. sp. (Figs. 19-24)

Length up to 0.75 mm. General color yellowish-white with purple irregularly margined stripes and spots dorsally in the following pattern:—one purple stripe beginning at base of antenna extends downward to cheek where a short fork extends slightly ventrally, the main stripe extends thence from the fork postero-laterally on the head toward the body where it becomes a broad lateral stripe which extends entirely around body and back to other cheek. Another stripe begins half way of body and extends posteriorly around abdomen and back to midway of body. The third stripe is situated dorsally on the body, the anterior ends weakly joined (separate in some specimens); both forks extend posteriorly to within one fourth of distal end of abdomen. A short purplish streak extends from the base of each eyespot posteriorly. On the front of head is a central purple spot containing two ocelli-like round black spots. Venter of head, body, legs, furcula yellowish-white. Antennae light purplish throughout (Figs. 19 and 20).

Eyes 8 on each side on black eyespots. Antennae longer than head or as: 43:30. Relative lengths of antennal segments as 4:14:20:5. Ant. 3 and 4 not subsegmented, with the 4th bearing definite whorls of hairs and an apical short, stout, distally bent sensory rod. Unguis (Fig. 23) rather straight and pointed, with one tooth on the inner margin one fourth from distal end, and two outer teeth near the middle. Unguiculus bearing a small inner spine and a knobbed subapical bristle, which extends slightly beyond the

apex of unguis. Tenent hairs absent. Dentes three times length of mucro, with 2 dorsal rows of setae; outer row consisting of 3 proximal simple setae and 5 serrate setae on distal half; with a lateral subapical bristle; 4 appressed ventral setae on distal half and a small short one at proximal end; and with 4 long setae on inner row. Mucro (Fig. 24) with both margins serrate, with about 26 serrations on inner margin. Rami of tenaculum (Fig. 21) tridentate, anterior lobe with 3 setae. Subanal appendages of female (Fig. 22) spinelike, curving distally.

Short stout bristles on front and vertex of head; smaller curving bristles on anterior of body, becoming short and stout on posterior end; anal segment with very heavy, broad spines dorsally. Lateral hairs of body fine and long.

Cotypes taken in leaf mould, Erwin, N. C. November 6, 1946. D. L. Wray; Hillsboro, North Carolina, Oct. 26, 1948, in leaf mould near Eno River, D. L. Wray. Cotypes in NCDA Insect Collection.

Dicyrtoma hageni var. *vinalis* n. var. (Figs. 29-33)

Structurally this form is similar to *D. hageni* Folsom, however, it differs in having fewer mucronal teeth, longer and more curving subanal female appendage, and mostly in color pattern. In *D.H. vinalis* the body is entirely wine red in color both dorsally and ventrally, while in *D. hageni* the venter of the body is not colored and the first segment of body is unpigmented (Figs. 25 and 29).

Length 1.0 mm. Head yellowish except for a vinaceous colored patch around each eyespot. Body deep rich wine red color both dorsally and ventrally. Legs and furcula yellow. First two antennal joints light, last two vinaceous. Eyes 8 on each side on light vinaceous eyespots. Antennae to head as 33:23. Relative lengths of antennal joints as: 3:11:14:4. Ant. 3 and 4 not subsegmented, with the 4th bearing definite whorls of hairs. Unguis (Fig. 30) rather straight and pointed with an inner tooth one fourth from distal end and two outer teeth. Unguiculus bearing a small inconspicuous inner spine and a distinctly knobbed subapical bristle which extends beyond apex of unguis. Tenent hairs absent.

Dentes three times length of mucro, with 2 dorsal rows of setae, the outer comprised of 2 basal simple setae and 5-6 serrate setae; 4 long setae on inner row; 4 repressed ventral setae on distal half. Mucro (Fig. 31) with both margins serrate, with 18-20 teeth on inner margin. Subanal appendage of female (Fig. 33) spinelike,

long, curving distally. Short erect simple setae posteriorly on abdomen.

Wilmington, North Carolina, March 23, 1943, taken in leaf mould, from pine woods, D. L. Wray. In NCDA Insect Collection.

***Dicyrtoma hageni* Folsom.** (Figs. 25–28)

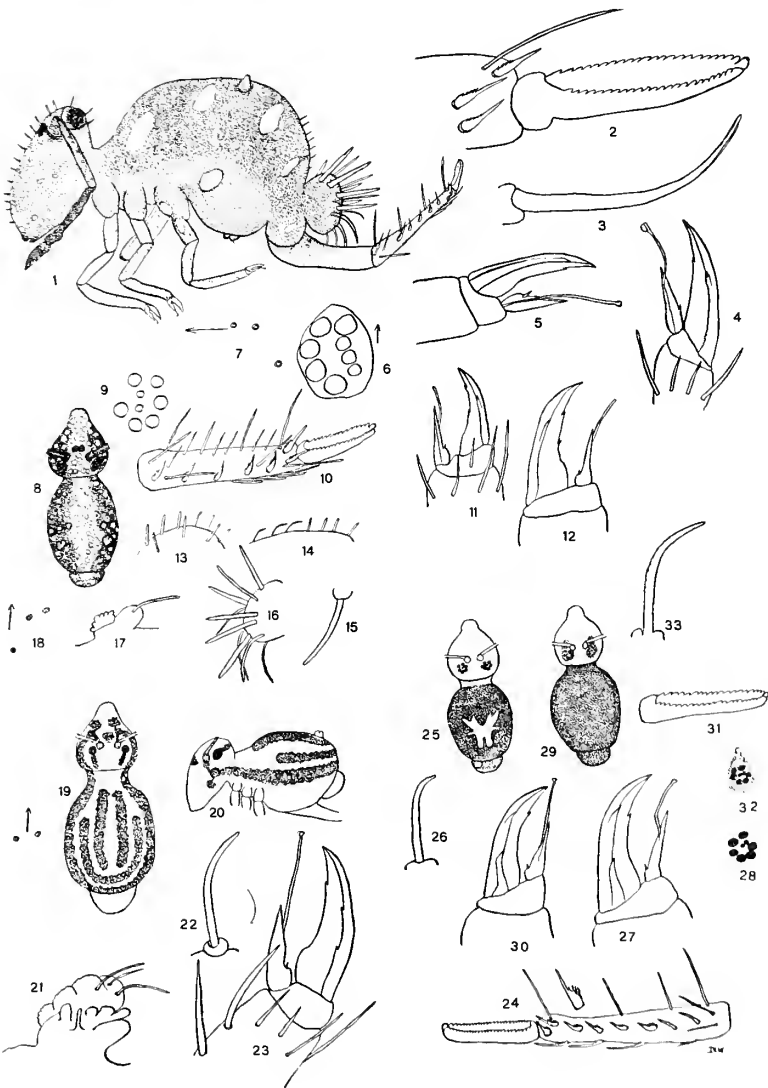
The specimens of this species taken were much smaller than given by Folsom, averaging 1.0 mm. in length, whereas he gives 1.5 mm. Taken in coastal areas so far: Castle Hayne, N. C., March, 30, 1943, in leaf mould, D. L. W.; Vanceboro, N. C., Nov. 16, 1946, leaf mould, D. L. Wray.

***Dicyrtoma frontalis* Banks, 1903**

This distinct and well marked species was taken at Raleigh, N. C. January 26, 1944, by D. L. Wray and C. S. Brimley, from rotten grass at edge of Lake Raleigh. I have compared these specimens with the type in the Museum of Comparative Zoology, Harvard College, Cambridge, Massachusetts. It is interesting to note that this probably is the first recovery of this interesting species since the original collection in Washington, D. C. in 1903 by Banks.

EXPLANATION OF PLATE IV

Dicyrtoma ochreous, n. sp. FIG. 1. Lateral view of body. 2. Mucro. 3. Female subanal appendage. 4. Left fore foot. 5. Left hind foot. 6. Left eyespot. 7. Lateral abd. bothriotrichia left side. *Dicyrtoma mithra*, n. sp. 8. Dorsal view. 9. Left eye. 10. Dens-mucro. 11. Left hind foot. 12. Left middle foot. 13. Spines on head. 14. Spines on posterior abdomen. 15. Female subanal appendage. 16. Lateral view anal segment showing spines. 17. Dorsal protuberance on posterior part of abdomen. 18. Position of bothriotrichia on lateral side of body. *Dicyrtoma curvilineata*, n. sp. 19. Dorsal view color pattern. 20. Lateral view color pattern. 21. Tenaculum and papillae. 22. Female subanal appendage. 23. Left hind foot. 24. Dens-mucro. *Dicyrtoma hageni* Folsom. 25. Dorsal view color pattern. 26. Subanal appendage of female. 27. Hind foot. 28. Eyespot. *Dicyrtoma hageni* variety *vinalis* new variety. 29. Dorsal view color pattern. 30. Left hind foot. 31. Mucro. 32. Eyespot. 33. Subanal appendage of female.



I wish to express my thanks and appreciation to Dr. Harlow B. Mills, for his help and suggestions, and to Dr. J. Bequaert, Curator of Insects, MCZ, Harvard University, Cambridge, Mass., for his kindness and permission to work there examining the types of various species.

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- . 1934. Redescriptions of North American Sminthuridae. *Iowa State College Journal of Science*, vol. VIII, no. 4, pp. 461-511. (Redescribes *Papirius hagenii* Folsom under *Dicyrtoma hageni* Folsom).
- Mills, Harlow B.** 1934. A Monograph of the Collembola of Iowa. Collegiate Press, Inc., Ames, Iowa, 143 pp., 12 Pls. (Describes *Dicyrtoma quadangularis* Mills).

Rhagionidae (Diptera) from the Great Smoky Mountains National Park. Five species of this family were collected by the writer and Robert R. Dreisbach in the Tennessee part of the park in 1946: *Chrysopilus connexus* Jns., Elkmont, June 15, 2 ♀♀; *C. ornatus* Say, Cherokee Orchard, June 14, ♀; *C. quadratus* Say, Elkmont, June 15, ♀; *C. rotundipennis* Lw., Cades Cove, June 13, ♂; *Rhagio vertebratus* Lw., Cherokee Orchard, June 11, Chimneys Camp, June 11, Headquarters, June 15, 3 ♂♂, 3 ♀♀. It is interesting to note that the only form found in Cades Cove (*Chrysopilus rotundipennis*) has a costal plains distribution. *Chrysopilus connexus* is apparently known only from the North Carolina mountains and Jacksonville, Florida. The others are more widespread.

—GEORGE C. STEYSKAL, Grosse Ile, Michigan.

THE OCCURRENCE OF *ANOMIS COMMODA* BUTLER IN THE UNITED STATES AND ITS LIFE HISTORY (LEPIDOPTERA, PHALAENIDAE, CATOCALINAE).

J. G. FRANCLEMONT, Arlington, Virginia.

In the fall of 1927 Laurent published a note in *Entomological News* (Volume xxxviii, 320) on the presence of *Rusicada fulvida* Guenée in the United States; Dr. McDunnough made the determination for Mr. Laurent. Guenée described *Anomis fulvida* in 1852 (*Spec. Gen. Lepid.*, vi (Noct. ii), 397); he listed as the locality "Amerique Septentrionale" and the Collection of the East India Company. If two or more specimens existed at that time, all but one have been lost as the only specimen¹ in the British Museum (Natural History) is the one from the Collection of the East India Company. This specimen is marked type and agrees in all details with the description. It is a member of a difficult complex of tropical, Indo-Australian species. This specimen and the description do not agree with the species occurring in the Eastern United States.

The species which Laurent collected and reared from larvae near Philadelphia, and which I collected and reared from eggs this year at Arlington is *Anomis commoda*. It was described as *Gonitis commoda* by Butler (*Ann. Mag. Nat. Hist.* (5), i, 203, 1878), and the female was figured later in the same year (*Illustr. Typical Specimens Lepid. Heter. Brit. Mus.*, ii, 36, pl. 32, fig. 3). The same species was described by Warren (*in* Seitz, *Grossschmetterlinge*, iii, 360, pl. 66, figs. B4 and B5, 1913) as *Rusicada fulvida* subsp. *subfulvida*; the figure of the male is labeled *fulvida*. Both types were from the Tokio-Yokohama area. This is a member of a small group of species which have become adapted to the warmer regions of the temperate zone, and which instead of retreating to the tropics with the approach of cold weather remain as pupae throughout the winter. The genitalia of our specimens agree exactly with those of Japanese specimens.

This species is more closely related to *Anomis crosa* Hbn. and *Anomis flava* than to any other species occurring in the Americas. In the McDunnough Check List it should precede *crosta* and be listed as follows,

¹ Dr. W. T. M. Forbes examined the Guenée type of *Anomis fulvida* in the Collections of the British Museum (Natural History) and in addition made notes on the group in general for me.

commoda Butl.
‡*fulvida* Auct.
subfulvida Warren

Anomis commoda has been collected at Mt. Airy, Philadelphia, Pennsylvania by Philip Laurent, at Moorestown, New Jersey by John W. Cadbury, III and near Minor Hill, Arlington, Virginia by myself. The date of introduction of this species into the United States is a matter of conjecture. I think it is safe to assume that Guenée did not have it before him in 1852 when he drew up his description of *fulvida*, because that description disagrees with this species in all its essential points. It is probable that the moth was introduced from Japan or China in the pupal stage with ornamental plantings of *Hibiscus* in the early part of this century. The point of entry is also a moot question. Thus far the only recorded food plant is *Hibiscus syriacus*, commonly called "Rose of Sharon" or "Althea."

The moth, mostly females, comes infrequently to light. During the past season I took five males and sixteen females at light; the first specimen caught on April twenty-third was a male, the second specimen on May second was a female, from this specimen a brood of moths was reared. The last specimen caught at light was on September twentieth, and the last larvae were found on October twenty-third; these were full grown and pupated within a few days. The moth was taken throughout the entire season; there are apparently three broods with considerable overlapping at Arlington. The larvae were also found on *Hibiscus syriacus* during the whole season; they were most abundant in July, but searching with a flashlight any night would generally reveal some larvae feeding on the foliage of the terminal branches. The larvae were more difficult to find in the daytime as they rested upon the young twigs of the food plant, and their color was an excellent match for that of the twigs.

The female moth caught on the second of May began laying eggs on the fifth and continued to do so for a period of almost four weeks, laying about three hundred and twenty-five. The eggs were very much flattened, slightly ribbed and pale yellow in color, darkening before hatching, which took place five days after oviposition.

The first instar larvae were yellowish upon hatching, but turned green after feeding; the tubercles were black; the first two pairs of prolegs were extremely reduced and not used in walking. The first moult occurred on the third day after hatching. In the second

instar the larvae were unchanged from the first. The second moult came three days after the first. In the third instar the black tubercles were very conspicuous; there was a faint indication of two subdorsal whitish lines; the two first pairs of prolegs were larger and were now used in walking. The third moult followed the second in four days; the larvae in the fourth instar were much like the previous one. The fourth and last moult followed in four days. The larvae in the final instar were greenish gray; the tubercles were black ringed with white; there was a tendency for the occurrence of dark hexagonal markings on the dorsum of each segment, but most noticeable on the first four abdominal segments. The head was brown, often marked with bright yellow-orange on the vertex. All the prolegs were developed, with only the first pair slightly less so than the others. The larvae were about one inch and three quarters long, somewhat slender and slightly depressed dorso-ventrally. They fed for five days, and then spun very flimsy cocoons among the leaves; pupation took place in three to four days, and the moths emerged after another twelve to fifteen days. About ten percent of this brood are overwintering as pupae. In nature I have found the cocoons spun in the angle where the porch roof joins the wall and in a single folded leaf on the food plant. The larvae were fed *Hibiscus syriacus*. In addition they were offered *Hibiscus esculenta*, Okra, and *Althaea rosea*, Hollyhock; one last instar larva fed for a short time on the former, but soon abandoned it and returned to the *H. syriacus*; no attempt was made by any of the larvae to eat Hollyhock.

Wanted.—Brief notes from 6 to 30 typed lines to fill such spaces as this are requested by the Editor.

FLIGHT NOTES: TWO PAPILIO, ONE KRICOSONIA

OTTO BUCHHOLZ, Roselle Park, New Jersey.

During my many years of collecting, I have observed several things which are probably of interest to the amateur, as well as the professional. For a long time, different friends of mine have asked me to publish some of them. So, with their insistence, I shall relate a few of them. I hope that they will be of some assistance to students interested in migrations, or if you prefer, mass flights.

PAPILIO PALAMEDES DRURY: All the males that I saw during the summer of 1938 to 1946 in the Dismal Swamp, near Suffolk, Va., were flying along the trail, in a westerly direction. All summer, from early morning to about one o'clock in the afternoon, they were on the wing. These specimens were all in good condition. The females were only found among the vegetation, ovipositing or seeming to be looking for a place to oviposit.

PAPILIO TROILUS ILIONEUS ABBOTT & SMITH: In May, 1947, at Royal Palm State Park (old name: Paradise Key), on the southern end of Florida, I saw numerous males gathering in a small clearing after four o'clock. They then would go through a "run" between the trees, finally ending up in the tall trees for the night. The females, like those of *P. palamedes*, were found only among the vegetation—not flying out in the open.

Instances of roosting are common in Florida and occur among a number of the species in several of the families.

KRICOSONIA LYSIDE GODART: Both males and females were observed traveling in a northwesterly direction on a government reservation southeast of Pharr, Texas. The territory is hot, dry, tropical desert scrub vegetation, with few moist places. What we observe here is probably a mass flight, such as is known to occur in the West Indies.

Editor's Note: This paper was written by Kent H. Wilson, but full credit is given to Mr. Buchholz as he was the observer.

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AMERICAN SYRPHID FLIES OF THE SUBFAMILIES CHEILOSINAE AND SYRPHINAE.

FRANK M. HULL, University of Mississippi.

Trichopsomyia urania n. sp.

A small, brassy black species with two large pale yellow spots upon the third abdominal segment. Perhaps related to *Currani* Fluke. Length 6.5 mm. excluding antennae; antennae 1 mm.

Male. *Head*: face and front and cheeks polished shining black. The front has a large opaque black triangle on the convex upper portion. The eye margins along the face are narrowly silvery white pubescent, and are almost confluent with a similar, scarcely wider, linear spot of such pubescence upon the ocular margin of the lower part of the front. The long fine pile in the middle of the face is white becoming black laterally; the frontal pile is long, and fine and abundant and entirely black except for a few white hairs in the center. The vertex is black and slightly brassy with black pile. The ocular pile is very dense, longer above and dark brown appearing black in some lights. There is a distinct, complete, horizontal, bare stripe running across the middle of the eye and a similar, wider bare stripe as wide as the vertical triangle, running from the vertical triangle along the posterior occiput downward and narrowing until it reaches the posterior limit of the horizontal stripe. The antennae are elongate; the first segment is reddish brown, the second reddish brown below and blackish above; and these two segments are of equal length. The third segment is blackish throughout or perhaps faintly dark brown at the base below. Viewed along its medial surface it is a little longer than the first and second segments together. *Thorax*: the mesonotum and scutellum are brassy black without evident vitta; the pile is rather long, especially upon the scutellum, abundant and

light yellow. The pleura and humeri are brassy black and the pleural pile is yellow except upon the pteropleura where it is blackish. Squamae brown with dark brown border and fringe. Halteres orange with a brownish knob. *Legs*: the femora are black and faintly brassy with the apices of the anterior and middle femora narrowly yellowish brown and the extreme apex of the hind pair obscurely dark brown. The anterior tibiae are very dark brown, the basal third diffusely brownish yellow. The middle tibiae are similar, the apex and basal half yellowish. Hind tibiae entirely dark, almost black, but perhaps actually very dark reddish sepia; their pile is entirely brownish black. The pile of the hind femora is brownish black except dorsally along the basal two-thirds and more narrowly basally where it is reddish brown and in places yellow. The first two segments of the anterior and middle tarsi are yellow, the remaining segments black. The apical third of posterior basitarsi, the second segment and the basal half of the third segment yellow with yellow pile, the remaining segments black with black pile. *Wings*: dilutely tinged with brown in the middle and still more faintly over the remainder of the wing where the brown tinge may be due to the thick villi. Stigmal area yellow. *Abdomen*: the first segment is brassy black. The second segment is black but only obscurely shining; it is rather greenish brassy across the middle, but subopaque posteriorly and basally. The pile is thick and brassy yellow except upon the posterior margin where it becomes dark and appears blackish. The pile on either side of the center of the segment is more or less appressed and directed laterally and towards the middle posteriorly. The third segment is obscurely shining brassy black, with a pair of very large, nearly quadrate, pale yellow spots which are slightly wider than long and separated in the middle by a distance fully equal to half their length; the anterobasal corners of these spots are rounded and truncate; the spots do not reach the lateral margins. The pile of this segment is yellow except upon the posterior margin. Fourth segment entirely shining brassy black, in shape subtriangular; the pile is abundant, short, erect and brassy yellow.

Holotype: male, Pucallpa, Peru, Dec. 9, 1947, Jose Schunke.

***Rhysops funerea* n. sp.**

An entirely black species with strong brassy reflections upon the thorax and the lateral margin of the abdomen. Wings heavily tinged with brown. Distinguished by these characters from *nigrans* Fluke. Length 9 mm.

Male. *Head*: face and front black and somewhat brassy, the sides of the face are very thinly yellowish grey pollinose; the pollen becomes thicker and more distinct narrowly along the eye margins. The facial pollen is not punctate and the sides of the face opposite the tubercle have one long and two or three microscopic, striate creases. Facial tubercle with one distinct crease above and faint traces of a second still more shallow crease. The pile of the face and front is black; the entire eye margins of the front are widely but obscurely dark yellowish grey pollinose. The middle of the front is biconvex with shallow, narrow, medial crease between. In front of these convexities lie a pair of shallow punctate depressions. The first segment of the antennae and the second are dark reddish brown, a little paler ventrally; the third is blackish above, reddish below. The first segment is distinctly shorter than the second and third combined; the first segment based on the dorsal length, is a little longer than the second but not quite as long as the dorsal length of the third segment. Arista missing. *Thorax*: mesonotum, scutellum and pleura black with strong brassy reflections; the mesonotal pile is light brownish yellow. The scutellar pile is longer and yellow with four or five long, slender, black, marginal hairs; ventral fringe quite long and yellowish. The squamae are pale brownish white with the margin and fringe brownish. *Legs*: black, the extreme apex of anterior and middle femora and the still more narrow base of their tibiae yellowish brown. All of the tarsi and the whole of the hind femora and tibiae are black. The pile of the legs is blackish; the mat of the hind tarsi however is brownish yellow, at least laterally. *Wings*: slightly longer than the abdomen and heavily tinged with brown which is darker in the middle and in the costal and marginal and submarginal cell and is still darker upon all of the cross veins and upon the stigmal portion of the subcostal cell. The third vein is quite straight. *Abdomen*: with parallel sides, dull black in color and only feebly shining down the middle but rather strongly metallic along the lateral margins.

Holotype: male, Nova Teutonia, Brazil, collected by Fritz Plaumann, Jan-March 1948.

This species is related to *nigrans* Fluke but in that species the male is described as having obscure yellowish spots which while more indistinct than in the female are present at least and can be discerned. In *nigrans* also the basal one-third of the tibiae are described as reddish yellow and the wings are only tinged with brown instead of being deeply brownish as in *funerica*.

***Allograpta harlequina* n. sp.**

A vittate species. Not close to described species. Length 8.5 mm.

Male. *Head*: cheeks brownish black; the face is pale yellow but very widely and sharply black in the middle over the tubercle; the black slightly decreases to the epistoma and expands above the tubercle. The face is concave in the middle with secondary tubercle above, beneath the antennae. The black of the face encircles the lower part of the front leaving the remainder of the front sharply whitish yellow with similarly colored pile. The first and second segments of the antennae are black; third missing. Eyes bare. The vertex is metallic black without pollen except upon the occiput; occipital pile pale yellow. *Thorax*: mesonotum metallic black with brassy reflections sublaterally and distinctly trivittate; the vittae are shining greyish green with brownish to greyish pollen. Humeri, notopleura and the area between sharply yellowish white. Postcalli pale yellow except anteriorly and posteriorly. The scutellum is pale yellow with a complete, rather wide, but diffuse dark brown preapical band; the declivitous base is also narrowly brown. The mesonotal and pleural pile is light yellow; all scutellar pile yellow. Pleura metallic black with well defined yellow area upon the posterior half of the mesopleura and all of the metapleura except its narrow posterior border. Squamae yellow. *Legs*: femora pale yellow, the hind pair becoming diffusely brown near the middle on the upper side and at the outer third below. The anterior and middle tibiae are wholly pale yellow; the hind tibiae are brown, a little paler at the base. All of the tarsi are dark brown. *Wings*: hyaline; the stigmal area is yellow but the basal half of the subcostal cell is rather darker yellow brown. Whole costal cell quite clear. *Abdomen*: first segment yellow but brassy black on a triangle upon the posterior border on each side. The second segment is wider than long, brownish black with, in the middle on either side, a triangular yellow spot distinctly separated in the middle. The anterior border of the spot is quite transverse but turned backwards a little at the margin; the posterior border is also straight but oblique. The yellow spots reach the posterior corners and reach the margin in full width. The third segment has a pair of bright, clear yellow, sharply marked, slightly oblique, vittate, posteriorly pointed, yellow spots which run from the base near the middle of the segment and diverge to end close to the posterior margin and almost as close to the lateral margin. The

fourth segment has similar, equally large, parallel-sided spots, also reaching from the base to about the same point posteriorly; these spots are not quite so wide as the preceeding pair and also are slightly less divergent but appear to be more divergent because the postero-medial aspect of these spots is rounded and leaves the spots pointed outwardly. The fifth segment has a pair of parallel, widely separated yellow spots which are elongate and oval; they are widest upon the base of the segment and reach nearly to the end of the segment.

Holotype: male, Santiago, Chile, March 30, 1944. Presented to the author by Senor Stuardo Ortiz.

Mesogramma intermedia n. sp.

This species is intermediate between *anthorata* Macquart and *tibicen* Wiedmann. It appears to be quite distinct from each of them. Length 10 mm.

Female. *Head*: the face is moderately produced. The cheeks and face are yellow and the middle of the face and tubercle broadly dark shining brown. The sides of the face are white pollinose with whitish pile and the yellow extends narrowly up the sides of the front; the pollen on this area is pale yellow. The intervening portion and remainder of the front and the entire vertex are black. The lower portion of the front is somewhat protuberant, polished black, transversely constricted above and with a medial linear line. The upper part of the front is opaque and from a side view dark brown pollinose with lighter pollen down the middle. The vertex is brassy between the ocelli which lie in an equilateral triangle but bright metallic blue immediately behind the ocelli and still further behind brassy. The vertical pile is short, scanty and yellowish but may appear black in some lights. The antennae are yellowish brown on the basal and second segments and narrowly upon the base of the third segment; the remainder of the third segment is black. The arista is reddish brown with the apex blackish. The occiput is densely brownish golden pollinose above becoming grey near the bottom. The occipital pile is shining yellow and considerably flattened in the middle. The middle of the posterior eye margins are rather deeply indented and there are three or four rows of the scalose pile at this point. *Thorax*: the mesonotum is black, heavily covered with golden brown pollen down the middle and this wide area is divided by a medial, wide, steel blue stripe which itself is divided in some lights by a narrow grey line. The lateral margins of the mesonotum and the entire margin of the scutellum,

the notopleura and the humeri are clear, distinct pale yellow, sharply set away from the dark color. The dark mesonotal color immediately adjacent to the yellow borders is dark brown pollinose merging diffusely and gradually into the submedial golden brown pollen. The posterior half of the mesopleura, a large oval spot on the upper border of the sternopleura and the propleura are pale yellow. Squamae and fringe yellow, the halteres yellow with a greyish brown knob. *Legs*: the anterior and middle femora are yellow with a faint diffuse, subapical brown annulus, their basal pile yellow; the middle femur black pilose apically. Anterior and middle tibiae entirely pale yellow. The first four segments of the anterior tarsi are quite black upon the dorsal surface except the extreme base of the first segment; their pile is reddish brown. The apical segment is yellowish brown and the ventral surface of these tarsi is yellow with golden pile. The middle tarsi are blackish upon the second, third and fourth segments and apex of the basal segment; the remaining segments are yellowish. Hind femur yellow on the basal third becoming diffusely brown and then almost black except the apex which is yellowish brown. These femora are black pilose on the dark areas and yellow pilose basally; hind tibiae dark brown at extreme base and apex and almost black between, their pile black. The dorsal surface of the hind basitarsi is light reddish brown with black pile above and golden pile below except the dorsal apex which is black; the remaining segments are black with black pile above. *Wings*: quite hyaline, elongate, the first posterior cell rather slender with a distinct dip in the third vein; the entire stigmal area is pale brown and the alulae well developed and wide. *Abdomen*: quite flattened, the sides of the second, third and fourth segments are emarginate; the first segment is yellow laterally, black transversely in the middle and on the posterior half but the posterior corners and whole lateral margins are yellow; the lateral pile is yellow, the remaining pile black. The second segment is narrowly brown across the base, narrowly yellowish in the anterior corners followed by a more narrow, opaque black band and in the middle of the segment a very slightly arched, complete yellow band which is approximately one-fourth as wide as the segment is long. This yellow band is bordered posteriorly by an opaque black band which in the middle is a little wider but becomes attenuated laterally until it is not quite as wide as the yellow band. The posterior margin of the second segment is occupied by a shining black band of uniform width and purplish reflections; its width is at least one-fifth the length of the segment. Third segment with a posterior shining

purplish black band equally as wide as the one on the second segment; immediately in front of this posterior shining band there is an opaque black fascia expanding gradually forward towards the sides of the segment to include the entire lateral margin; the black becomes quite narrow as it reaches the base of the segment. In the middle of the segment the black is produced forward to form an expanding wedge of opaque black which is wide and bluntly triangular on the anterior half of the segment but which does not quite reach the base of the segment. The remainder of the segment is light brownish yellow. The fourth segment is somewhat similar except that the expanding, posterior, opaque fascia only reaches two-thirds of the length of the lateral margin; the anterior third is yellow and this segment has a similar, equally large, medial, blunt, triangular wedge in the middle of the segment which narrowly touches the base of the segment and is bisected by a yellowish brown vitta. This medial yellow brown vitta does not reach the base of the segment. The remainder of this segment is also light brownish yellow and the posterior margin violaceous. Fifth segment with posterior margin shining black, a low black triangle on either side and a medial wedge expanded to become a trifurcate spot anteriorly; the middle prong touches the base. These areas are opaque black and the remainder of the segment is light yellow.

Holotype: female, Pucallpa, Peru, Dec. 1947, Jose Schunke.

This species differs from *anchorata* Macquart in that the posterior black fascia of the third segment extends to the base of the segment laterally; also the medial wedge-like triangles are larger, more blunt upon their lateral extensions and the one upon the fourth segment is not only bisected but extends to the base of the segment. This species differs from *tibicen* Wiedemann in the fact that the medial triangle of the third segment is wider, more acute laterally and does not reach the base and upon the fourth segment it differs because the black posterior fascia extends widely across and includes the lateral margin.

STUDIES ON THE COLEOPTERA OF THE PACIFIC
NORTHWEST III: CARABIDAE: HARPALINAE.

By MELVILLE H. HATCH, Seattle, Washington.

The specimens on which this study is based are in the collection of the author at the University of Washington.

***Platysma (Hypherpes) craterense*, sp. n.**

Black, alutaceous, shining, the under surface and legs feebly picescent; pronotum about six-sevenths as long as wide, the sides entire, broadly arcuate, sinuate before the bluntly rectangular hind angles, the basal margin sinuate, margined towards the sides, the inner basal impression deep, linear, the region between it and the lateral margin usually tumid with the outer basal impression usually a more or less discrete foveiform impression; elytra with the striae deep, impunctate, the intervals feebly convex, the humeri feebly dentate, the apices beyond the lateral sinuation more or less feebly obliquely sinuato-truncate; prosternum margined at tip; metafemur unmodified in male, the posterior upper margin arcuate; last abdominal sternite unmodified, not carinate in male; aedeagus spinosely produced at apex; length 11–14 mm.

Type ♂ allotype ♀, and 18 paratypes: Crater L., Ore., June 28, 1934, M. H. Hatch. Three paratypes: McKenzie Pass, Ore., June 21, 1930, M. H. Hatch. One paratype, same data, McKenzie R. Single specimens lack the outer basal pronotal impression entirely or have it linear with the entire region between it and the inner impression broadly impressed. From related forms, *craterense* is usually distinguished by its obliquely sinuato-truncate elytral apex and the shape of its aedeagus; from the lowland *algidum* LeC. it is further distinguished by its dentate humeri and unmodified male metafemora; and from *brunneum* Dej. and *protractum* LeC. by the tumidity between the inner basal pronotal impression and the hind angle.

Platysma (Hypherpes) scutellare LeC. must be removed from the Oregon list (Schaupp, Bull. Brook. Ent. Soc. 1882, p. 40), since it does not occur north of Sonoma Co., Calif. (Van Dyke, Pan-P. Ent. II, 1925, p. 70).

***Platysma (Cryobius) shulli*, sp. n.**

Body black, shining, not or very finely alutaceous, the lateral apical margin of the elytra very narrowly rufous or translucent, the ventral surface rufopiceous, the epipleurae and legs rufous,

mouthparts rufous, the extreme tip of the palpi flavous; antennae with the three basal segments rufous, the distal segments piceous, the apex of the last segment somewhat paler; pronotum about three-fourths as long as wide, moderately narrowed behind, the base nearly as wide as the apex, the side margins curving out almost immediately from the rectangular hind angles, transverse apical and transverse basal impressions present, the impressed median line nearly entire, the basal impressions bistriate, the outer stria less distinct, the striae coalescent behind forming a coarsely punctate narrow fovea, its floor slightly convex, the region between the fovea and the side margin feebly carinate, the entire hind angle rather strongly reflexed, the basal margin towards the hind angle finely to evanescently margined; elytra with eight entire moderately impressed not or vaguely punctate striae and an evident scutellar stria that has an ocellate puncture at its base, the intervals flat, the third stria with two dorsal punctures near the second stria; male with three basal protarsal segments dilated, the posterior margin of the last abdominal sternite with a single anal seta on either side, female with undilated protarsi and two anal setae; length 8-8.5 mm.

Type ♂ and allotype ♀: Pierce, Idaho, May 23, 1929, alt. 3200 ft., W. E. Shull, collector. Named for its collector, a well-known Northwestern entomologist. Distinguished from other species of *Cryobius* in the Northwest (*patulum* Csy., *laevilatum* Notm., *humidulum* Van D.) by the more strongly reflexed hind angles of the pronotum, the sides curving out almost directly from the hind angles.

***Amara* (s. str.) *san-juanensis* sp. n.**

Very convex; black, shining, impunctate, the upper surface aeneous, the elytra finely alutaceous, somewhat more opaquely so in the female, the antennae with the basal segments scarcely paler, the second and the third segments not carinate, the ventral surface and legs sometimes piceous; pronotum about three-fifths as long as wide, widest slightly in front of base, the apex about three-fifths as wide as the base, the sides broadly arcuate from the rounded slightly obtuse hind angles, the posterior seta-bearing puncture closer to the basal than to the lateral margin, the basal impressions consisting of a feeble foveiform outer and a feeble linear inner impression, the impressed median line attaining neither apical nor basal margin; elytral striae scarcely punctulate, finely impressed, the outer ones and the scutellar stria more finely and at times incompletely impressed, the scutellar stria without a seta-bearing puncture at its

base; prosternum at the middle in the male with a more or less evident punctate fovea, sometimes absent or evanescent, in the female unmodified; protibiae with terminal spur normally slender; femora with two setigerous punctures along inner margin; last abdominal sternite with one (male) or two (female) anal setae on either side along the apical margin; length 5.7–6.5 mm.

Type ♂, allotype ♀ and eight paratypes: San Juan Is., Wash., Brown's Is., July 30, 1933, M. H. Hatch. Two paratypes: San Juan Is., Wash. July 14, 1933; one paratype same data, July 8, 1933. One paratype: Van Horn, Wash. Apr. 28, 1930, A. D. Horn. From *insignis* Dej. and *insularis* Horn, to which this species runs in Hayward's (Trans. Am. Ent. Soc. XXXIV, 1908, p. 49) and Casey's keys (Mem. Col. VIII, 1918, p. 393), *san-juanensis* is distinguished by its smaller size and smaller number of femoral punctures.

***Amara (Celia) amplicollis* Mann. (*brunnea* Horn nec Gyll.).**

Washington specimens that correspond closely with Horn's description (Trans. Am. Ent. Soc. XIX, 1892, p. 39) of *brunnea* Gyll. differ from European specimens by their bluntly rectangular rather than obtusely rounded pronotal hind angles. Consequently I suggest the adoption for the present of Mannerheim's name for Northwestern material, even though his description (Bull. Soc. Imp. Nat. Moscou 1853, p. 139) calls somewhat ambiguously for hind angles "subrotundatis."

The variability in the shape of the mentum tooth in *amplicollis*, in *exlineae* Minsk and Hatch, and in certain species of the *musculus*-group leads me to abandon the use of the subgenus *Acrodon* Zimm. (Minsk and Hatch, Bull. Brook. Ent. Soc. XXXIV, 1939, pp. 215–216) and to suggest that its species be incorporated in the *musculus*-group to some members of which they are very similar.

***Amara (Celia) wakelandi*, sp. n.**

Form oblong more than twice as long as broad; shining black or dark rufous, above finely alutaceous, scarcely more evidently so in female, the antennae and legs somewhat paler; pronotum from three-fifths to seven-tenths as long as wide, the apex about two-thirds as wide as the base, the apex from above feebly emarginate, the front angles broadly rounded, the side margins before the obtusely rounded hind angles slightly divergent and broadly evenly arcuate, the outer and inner foveae of the basal impressions well impressed and sparsely coarsely punctate, the surface between the

outer fovea and the side margin convex, the median line nearly entire; elytral striae entire, finely impressed, finely punctulate, the intervals nearly flat, the scutellar stria well developed and without an ocellate puncture at its base; below impunctate; male prosternum with a flattened area of fine punctures at the middle, unmodified in female, the apex of the prosternum margined and without setae; last abdominal sternite with two anal setae on either side along the posterior margin in both sexes; length 7-8 mm.

Type and two paratype males and allotype female: Succor Cr., Ida. 7-30-1926. Collector C. Wakeland. Distinguished from *rectangula* LeC. by the obtusely rounded hind angles and the more arcuate side margins of the pronotum and from *remotestriata* Dej. by the absence of setae from the apex of the prosternum. Named for its collector, Dr. Claude Wakeland, formerly connected with the University of Idaho.

***Amara (Zezea) kincaidi* Minsk and Hatch.**

The original description (Bull. Brook. Ent. Soc. XXXIV, 1939, pp. 217-218) of this species erroneously reports two anal setae on either side along the posterior margin of the last abdominal sternite in both sexes. The males possess only one such seta, the females two.

***Axinopalpus pratti*, sp. n.**

Piceous black, shining, finely alutaceous, the antennae, mouthparts, legs, median portions of the sterna, and an elytral fascia extending from the humerus about four-fifths the distance to the suture and about one-third the distance to the apex testaceous, the femora clouded with piceous; pronotum about three-fourths as long as wide, the base and apex equal in width, the hind angles obtuse, minute, the sides in front of the hind angles sinuate, the basal margin just within each hind angle arcuate and then sinuately continuous with the subtruncate basal lobe, the median line evident and connecting evident anterior and basal transverse impressions; elytra with striae finely evanescently impressed, the third interval with two dorsal punctures near the third stria, the apices evenly subtruncate, the sutural and outer apical angles rounded; length 3 mm.

Type: Coupeville, Wash., Sunnyside, June 29, 1944, M. H. Hatch. Named in honor of Mr. Robert Y. Pratt, at whose home I was a guest when the type was secured. Distinguished from *illectus* Csy. by its blunt pronotal hind angles.

***Axinopalpus denticulatus*, sp. n.**

Piceous, shining, finely alutaceous, the antennae, mouthparts, tibiae, tarsi, most of the ventral surface and oblique elytral fasciae extending from the humeri about half way to the apex and four-fifths the distance to the suture testaceous; pronotum about three-fourths as long as wide, the base and apex about equal in width, the hind angles rectangular, prominent, the sides in front of the hind angles sinuate, the basal margin just within each hind angle slightly oblique and then sinuately continuous with the subtruncate basal lobe, the median line evident and connecting the evident anterior and basal transverse impressions; elytra with the striae almost completely absent, with two dorsal punctures, the apices each with a minute acute spine just laterad to the sutural angle, the sutural and outer apical angle rounded; length 2.75 mm.

Type: Grand Coulee, Wash., Dry Falls, May 7, 1938, M. H. Hatch. Distinguished from other Nearctic species by the spinose elytral apices.

***Axinopalpus vittatus*, sp. n.**

Rufous, shining, very finely alutaceous, the following testaceous: mouthparts, antennae, legs, most of the ventral surface, hind angles of the pronotum, and oblique elytral vitta that extends from the humerus nearly four-fifths the distance to the apex of the elytra and about four-fifths of the distance to the suture, and a broad band along the anterior three-fourths of the lateral margin of the elytra; pronotum about three-fourths as long as wide, the base and apex equal in width, the hind angles subrectangular, minute, the side margin slightly sinuate in front of the hind angles, the basal margin within the angles slightly oblique and then sinuately continuous with the subtruncate basal lobe, median line evident and connecting the evident anterior and basal transverse impressions; elytra with the striae evanescent, the third interval with two fine dorsal punctures near the third stria, the apices evenly subtruncate, the sutural and outer apical angles rounded; length 3 mm.

Type: Seattle, Wash. (from the collection of O. B. Johnson). This species is most closely related to the Californian *demissus* Csy., from which it is distinguished by its paler color (which may be due to immaturity in the type), its more extensive elytral vittae, and perhaps by its less prominent posterior pronotal angles.

***Harpalus (Epiharpalus) affinis* Schrank (*viridiaeneus* Beauv.).**

I find no differences between American and European specimens.

This conclusion is based on a comparison of specimens from Austria, Czechoslovakia, Croatia, Massachusetts, Ontario, Michigan, and Washington, and includes a comparison of male genitalia. The species is widely distributed throughout the Palaearctic Region and may be native in North America, whence *viridiaeneus* was described in 1805. According to Reitter (*Fauna Germ. Käfer I*, 1908, pp. 172-173) and Csiki (*Col. Cat.* 121, 1932, pp. 1133-1135) the typical form *affinis* Schrank (= *confusus* Dej.) has the femora piceus, with the ab. *viridulus* Fourcroy (= *aeneus* F.) having the legs entirely pale. The aberrational name *semipunctatus* Dej. is applicable to specimens with the seta-bearing punctures extending over the inner as well as the two or three outer elytral intervals. Black or bluish specimens are assigned respectively to the ab. *melas* D. Torre (= *nigrinus* Schilsky) and the ab. *coerulescens* Schilsky, but I have seen neither of these varieties from America. Casey (*Mem. Col. V*, 1914, pp. 74-75) was in error in placing this species in the subg. *Harpalophonus* Gangl.

***Harpalus (Amblystus) cascadiensis*, sp. n.**

Black, the lateral marginal beading of the pronotum obscurely rufous, the extreme bases of the legs and the tibiae and tarsi piceous, the antennae and mouthparts testaceous, dorsal surface shining and finely alutaceous in male, opaque and more coarsely alutaceous especially on the elytra in female; head from seven-tenths to three-fourths or more as wide as the pronotum; pronotum transverse, the apex about five-sevenths as wide as the base, the sides evenly broadly arcuate, the hind angles narrowly obtusely rounded, the sides very narrowly deplanate in front, behind the middle somewhat more widely so, with a single marginal seta in front of the middle, the surface finely punctulate, coarsely densely punctate at basal fourth and along marginal gutter, the apical and basal transverse impressions feeble, the basal impressions linear and rugose, the surface lateral to the basal impressions convex, the median impressed line fine and attaining neither anterior nor posterior margins; elytra with striae well impressed, entire, impunctate, the intervals nearly flat except towards apex, the third interval with two impressed dorsal punctures (rarely one or three on one side) behind middle near the second stria, the humeri finely dentate; mentum edentate; abdominal sternites four and five without accessory setae in addition to the single long seta on either side of middle; pro- and mesotarsi dilated in male, narrow in female; length 11-11.5 mm.

Type and 20 paratype males, allotype and 11 paratype females, Van Horn (Skagit Co.), Wash. Apr. 26, 1930, A. D. Horn. A single paratype female: S. Gabriola I., B. C. 9-11-1908. B. R. Elliott. This species runs to the *viduus*-group (= subg. *Pheuginus* Motsch.) in Casey's key (Mem. Col. V, 1914, p. 70) from which it is distinguished by its two dorsal punctures. The densely punctate hind angles and the broadly arcuate side margins of the pronotum place it in the subgenus *Amblystus* Motsch. (cf. Reitter, Fauna Germ. Käfer I, 1908, pp. 172, 174-175). Comparison of specimens of *cascadiensis* with specimens of various European species of the subg. *Amblystus* shows it to have a general facies that is quite congruent with a position in that subgenus. The two dorsal punctures of *cascadiensis* ally it with *quadripunctatus* Dej., which is distinguished by its slightly smaller size and usually pale legs.

***Harpalus (Pheuginus) atrichatus*, sp. n.**

Dark rufous, shining, scarcely alutaceous, the elytra coarsely alutaceous in female, the antennae, the mid-ventral region, and the bases of the legs somewhat paler; head about three-fourths as wide as pronotum; pronotum about seven-tenths as long as broad, the apex about three-fifths as wide as the base, the sides arcuate in front, oblique in front of the obtusely narrowly rounded hind angles, not at all explanate, the anterior and posterior transverse impressions feeble and connected by the finely impressed median line, the region of the linear basal impressions diffusely variably punctate; elytra with striae impressed, entire, impunctate, the intervals flat, without a dorsal puncture (a single dorsal puncture present on third interval near second stria behind middle on one side in one of the six specimens seen), the humeri finely dentate, the apical sinus feeble; abdominal sternites four and five without accessory setae in addition to the single long seta on either side of middle; pro- and mesotarsi dilated in male, narrow in female; length 8-9 mm.

Type and paratype male, Ocean Park Wash., August 14, 1935. Allotype female, Friday Harb., Wash., 7/15 '24. Three paratype males: Bay Center, Easton, and Friday Harbor, Wash. This species runs to the *viduus*-group (= subg. *Pheuginus* Motsch.) in Casey's key (Mem. Col. V, 1914, p. 70) from other members of which it is distinguished by the usual absence of a dorsal puncture. The general shape and structure of the pronotum is likewise highly characteristic.

Harpalus (Lasioharpalus) couleensis, sp. n.

Black or dark rufous, the ventral surface and legs somewhat paler, the antennae testaceous, the margins of the pronotum and elytra narrowly translucently paler; upper surface shining, the elytra finely alutaceous, more finely so in male; head about two-thirds to seven-tenths as wide as pronotum; pronotum about two-thirds as long as wide, the apex about four-fifths as wide as the base, the apex in dorsal view nearly truncate, the side margins arcuate in front, nearly oblique and feebly convergent before the moderately arcuate hind angles, the sides with a narrow marginal gutter and not at all deplanate, the disc punctulate, sparsely punctate towards the hind angles, the basal impressions feebly impressed, the basal margin transverse, the hind angles not more posterior than the middle; elytra with the striae impressed, evanescently punctulate, the intervals feebly convex, the third interval with a single dorsal puncture behind the middle, the humeri finely dentate, the sutural angles narrowly rounded; mentum dentate; abdomen with sternites four and five with accessory setae forming conspicuous transverse lateral series in addition to scattered setae more antero-medially located; pro- and mesotarsi wider in male than in female; metatarsi with basal segment much shorter than fifth; length 7-9 mm.

Type male, allotype and three paratype females: Upper Grand Coulee, May 2, 1937, M. H. Hatch. Eight paratypes; Grand Coulee (Dry Falls), Electric City, Deadman Lake (Adams Co.), Neppel (Moses Lake), Kahlotus Lake, all in eastern Washington. Placed in the subgenus *Lasioharpalus* Reitt. (= *fraternus*-group of Casey) by the accessory setae on sternites four and five. It is related to *albionicus* Mann. and *obesus* LeC. From these it is distinguished by its sparsely punctate posterior pronotal angles, and from *obesus* by its more broadly rounded posterior angles. The legs and ventral surface are apparently darker than in *albionicus*.

Harpalus subg. Cordoharpalus, subg. n.

Generitype: *Harpalus cordifer* Notman = *washingtoniensis* Van D. Pronotum with the sides subparallel and then distinctly sinuate and distinctly widened in front of the sharp slightly obtuse hind angles, not flattened latero-basally, the hind angles densely punctate up to the lateral margin; elytra glabrous, without a dorsal puncture, the apical sinus dentate externally; mentum toothed; tarsi glabrous above; abdomen with sternites four and five without setae other

than the single seta on either side of the middle. Distinguished from other subgenera of *Harpalus* by its posteriorly sinuately narrowed pronotum.

Casey (Mem. Col. XI, 1924, p. 94) assigned *H. cordifer* to *Opadus* Csy., from which I distinguish it by the absence of serial punctures towards the apex of elytral intervals 3-5-7.

***Anadaptus idahoensis*, sp. n.**

Piceous black, shining, the basal antennal segment paler, the upper surface aeneous or viridaeneous; head above set with coarse setigerous punctures; pronotum nearly three-fourths as long as wide, the apex nearly three-fourths as long as the base, the sides very narrowly reflexed, slightly more widely so towards hind angles, the hind angles narrowly rounded, in front of which the sides are oblique, the disc punctulate, the surface with coarse setigerous punctures towards the anterior and posterior margins especially in the anterior and posterior transverse impressions and in the moderately deep linear basal impressions, between the basal impressions and the side margin the surface is moderately convex; elytra shining and finely alutaceous in male, more opaquely alutaceous in female; intervals two, four, six, and eight densely set with setigerous punctures; intervals one, three, five, and seven convex, their axial portions more sparsely set with setigerous punctures in female, the punctures on these intervals in the male confined to the margins of the intervals except towards the apex; elytral apex strongly sinuate; thorax and abdomen below setulose, the thoracic side-pieces and the sides of the basal abdominal segments glabrous; length 8.5-10.5 mm.

Type male and allotype female: Sand Point, Id. June 20, 1937, Hortense Lanphere. Three paratype females Sand Point and Moscow, Id. Distinguished from *porosus* Mots. by its more densely punctate first, third, fifth, and seventh elytral intervals, the narrowly rounded posterior pronotal angles (subrectangular in *porosus*) in front of which the side margin is oblique (vaguely sinuate in *porosus*), the reflexed pronotal margins wider towards the hind angles (not widened in *porosus*).

**A DESCRIPTIVE STUDY OF THE LIFE HISTORY
STAGES OF THE DOG BITING LOUSE, TRICHOD-
ECTES CANIS (DEGEER) (MALLOPHAGA:
TRICHODECTIDAE).**

By MAXWELL M. CRYSTAL, Bronx, New York.

INTRODUCTION.

The characteristics of nymphal instars of the dog biting louse, *Trichodectes canis* (DeGeer), are not as well known as are those of the adults. A brief survey of the literature has revealed very few studies of immature forms of Mallophaga. In this paper a study has been made of the morphological characteristics of the life history stages of the dog biting louse: the egg, three nymphal instars, and adult.

T. canis is found in the United States, Europe and Australia as an ectoparasite on the dog *Canis familiaris* (Linn.). McGregor (1917) describes what he believed to be a second species of biting louse, *T. floridanus*, found on the dog in the United States. Ewing (1936) reports that he has found some specimens from the dog which are intermediate in morphology between *T. canis* and *T. floridanus*, albeit nearer the former. The specimens studied in connection with this problem seem to occupy such a median position. It is suggested that the species *T. canis* and *T. floridanus* may be but morphological variations of the same species. However, demonstration of this statement remains to be presented.

Preserved biting lice originally removed from a dog in 1934 in Columbus, Ohio were bleached, dehydrated, cleared and then mounted in Clarite for study. The instars were distinguished on the basis of head capsule width measurements after the principle of Dyar (1890) and morphological characteristics. It was found that the common ratio for the progression of head capsule width measurements of the dog biting louse was about 1.25. All descriptions were rechecked from material acquired from a dog in Columbus, Ohio (1948).

DESCRIPTIONS OF THE LIFE HISTORY STAGES.

Egg.

The egg (Fig. 7) is elongate and broadly oval and it is twice as long as it is wide. At the attached end it is somewhat truncated. Except for the lid the shell surface is smooth. The egg is fastened to a hair at its basal end by a cement substance along a straight

inner surface equal to from one-third to one-half the total length. The opposite end, from which the embryo emerges, is furnished with a circular cap, the operculum. This lid bears the micropylar apparatus which consists of a number of papillae arising from the peak of the operculum. The papillae are inclined towards the center and each is narrower at its base than it is distally. A number of transverse folds are present on each papilla. The spaces between adjacent papillae are invested with chorion.

The average length of the egg was 0.83 mm. and the average width at the widest part was 0.42 mm.

First Nymphal Instar.

The head of the first instar nymph (Fig. 8) is slightly wider than it is long and the anterior margin is semicircular with a tendency toward being truncated anteriorly rather than indented. In front of each antenna the anterior margin is produced into prominent trabecula-like processes (Fig. 4). The antennal sinuses are distinct but not deep. Behind the bases of the antennae are the distinct ocular projections. Immediately behind the eyes, the temporal margins commence to converge and meet the occipital margin with an obtuse curvature. The occipital margin is but slightly convex for the entire width of the prothorax. The anterior margin is furnished with several hairs. A short hair is present at the base of each trabecula just over which a longer hair arises. One short hair arises just mesad of each eye and one behind this. Several short hairs are present along the posterior margin with one long hair arising near the temporal angle.

The basal segment of the antenna (Fig. 1) is but slightly wider than either of the remaining two segments. The third segment is nearly equal in length to the other two combined. There are two small circular sensoria close together on the ventral surface of the third segment.

The thorax is slightly narrower than the head and more than twice as wide as it is long. The prothorax is broad, with the median portion of the hind margin slightly concave. A pair of protruding spiracles are borne, one along each obliquely rounded lateral margin. There is a long bristle on each side of the pronotum near the hind margin midway between a median line and the lateral border. The sides of the pterothorax (the united mesothorax and metathorax) converge posteriorly and the posterior margin is shallowly concave. There is one short bristle at each anterior lateral angle. Mesad of each lateral border a long bristle arises.

A median pair of short bristles is located along the posterior margin.

The first pair of legs is shorter than the other two pairs. The fore coxae lie close to one another in the center. The tibiae of the second and third pairs of legs are longer than those of the first pair. All tarsi are two-segmented. The claws of the prothoracic legs are stout while the claws of the other legs are long and slender. In addition to several short bristles on each leg segment, the tibiae are furnished with apical spurs.

The abdomen is widely oval in outline. The terminal segment is deeply emarginate medially. Two transverse rows of hairs are present medially on the first segment which is longer than the succeeding segments. The anterior row consists of two hairs and the posterior row of about six hairs. A bristle arises from each posterior lateral angle and anterior to this another bristle arises. The second to the sixth segments (inclusive) are each furnished with a transverse row of about six hairs with the median pair of hairs long. The hairs are arranged one behind the other to form four distinct longitudinal columns. A long bristle arises from each posterior lateral angle of these segments. On segment VII a pair of long hairs originates, one from each posterior lateral angle. On either side of the emargination of the terminal segment about two short hairs arise.

The average total length of the first nymphal instar was 0.76 mm. The average length of the head was 0.26 mm.; the thorax, 0.11 mm.; the abdomen, 0.39 mm. The average width at the widest part of the head was 0.32 mm.; the thorax, 0.30 mm.; the abdomen, 0.42 mm.

Second Nymphal Instar.

In the second nymphal instar (Fig. 9) a small median portion of the anterior margin of the head exhibits a very slight emargination. The antennal sinuses are somewhat deeper and the ocular projections are prominent (Fig. 5). A somewhat similar distribution of the marginal hairs on the head in this instar is evident as compared with instar I. The antennae (Fig. 2) are similar to those of the first instar.

The thorax is narrower than the head at the cervical joint and it is about three times as wide as it is long. An additional bristle has appeared on the pronotum mesad of each spiracle. Along the lateral border of the pterothorax four to five bristles are present. A transverse row of four bristles arises from the dorsum near the hind margin.

The abdominal segmentation remains unchanged. Each of the abdominal segments II to VII (inclusive) now bears a pair of spiracles, one near each lateral ventral border. The number of bristles on the abdominal tergites have increased. Segment I bears two transverse rows of hairs. An anterior median series consists of two to four hairs. A posterior series of about fourteen hairs is distributed in a median group of four to six hairs and two lateral groups of five to six bristles each. Along each lateral border is present a bristle anterior to the one arising from the posterior lateral angle. The chaetotaxy of segments II to V (inclusive) is similar to the hind series of hairs on segment I. Segment VI bears a transverse row of about eight bristles divided into two groups of four hairs each. Only two hairs make up the lateral groups of segment VII. The terminal segment bears a transverse series of four short bristles. An over-all view of the dorsal abdominal chaetotaxy shows the arrangement of hairs in two lateral longitudinal columns and one median column.

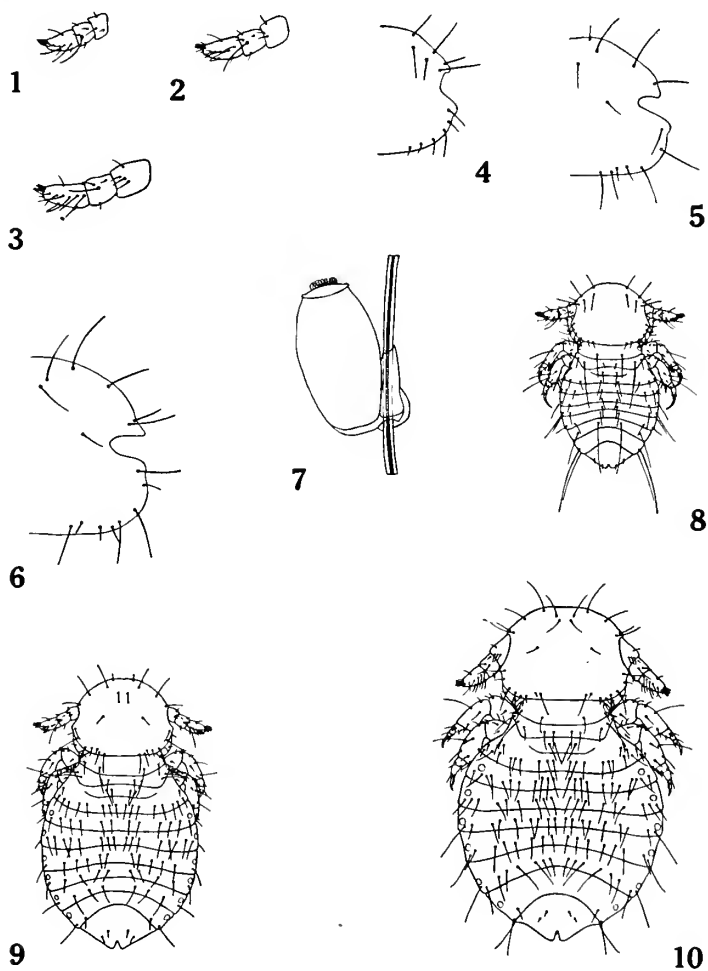
The average total length of the second nymphal instar was 1.09 mm. The average length of the head was 0.31 mm.; the thorax, 0.14 mm.; the abdomen, 0.64 mm. The average width at the widest part of the head was 0.41 mm.; the thorax, 0.42 mm.; the abdomen, 0.63 mm.

Third Nymphal Instar.

The nymph of the third stadium (Fig. 10) presents a basal antennal segment as wide as it is long (Fig. 3). The length and width of the second antennal segment are also equal but this segment is smaller in size than the first segment. Antennal segments 1 and 2 combined are one-quarter again as long as the third segment. Several hairs are present dorsally on the head (Fig. 6) as well as marginally.

The hind border of the pterothorax is now margined by a transverse row of about six bristles.

Additional bristles on the abdomen are present as follows: Segment I bears an anterior transverse row of about six bristles. Behind this arises a transverse row of about eight median bristles and a group of three bristles on each side of these. Each lateral border is furnished with a cluster of about ten bristles distributed in four ill-defined transverse rows. Segments II to VI (inclusive) each bear a transverse row of six to eight median bristles with a group of three bristles on either side of this median group. The number of lateral bristles on nymphs of the third stadium are not



EXPLANATION OF PLATE V

FIG. 1. Antenna, first nymphal instar, dorsal aspect. FIG. 2. Antenna, second nymphal instar, dorsal aspect. FIG. 3. Antenna, third nymphal instar, dorsal aspect. FIG. 4. Right half of head, antenna removed, first nymphal instar, dorsal aspect. FIG. 5. Right half of head, antenna removed, second nymphal instar, dorsal aspect. FIG. 6. Right half of head, antenna removed, third nymphal instar, dorsal aspect. FIG. 7. Egg. FIG. 8. First nymphal instar, dorsal aspect. FIG. 9. Second nymphal instar, dorsal aspect. FIG. 10. Third nymphal instar, dorsal aspect.

constant from segment to segment. As many as five setae are present laterally on segment II and the number found on the succeeding segments of the abdomen decreases consecutively until segment VI from which only one or two lateral bristles arise. Four bristles are present on segment VII, two at each lateral posterior corner. Two pairs of very short bristles are present on the terminal segment.

The average total length of the third nymphal instar was 1.35 mm. The average length of the head was 0.36 mm.; the thorax, 0.15 mm.; the abdomen, 0.84 mm. The average width at the widest part of the head was 0.52 mm., the thorax, 0.45 mm.; the abdomen, 0.81 mm.

Adult.

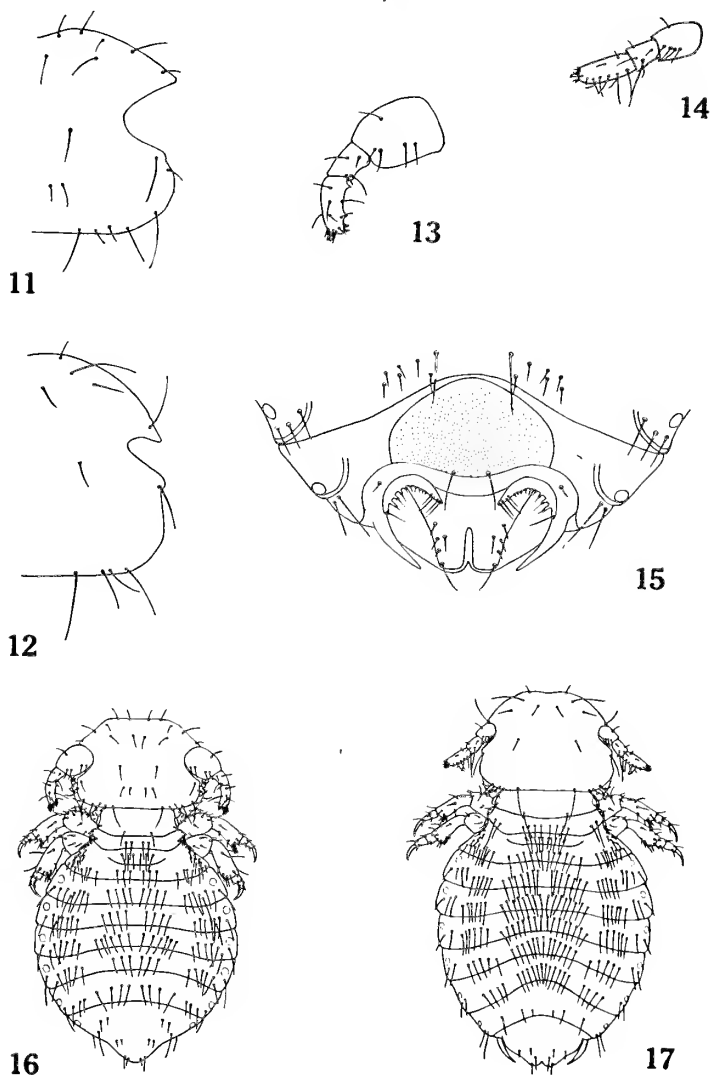
The female (Fig. 17) is larger than the male (Fig. 16). The head of both the male (Fig. 11) and the female (Fig. 12) is one and one-third times as wide as it is long. The median portion of the anterior margin of the head is but slightly emarginate. In the female the ocular projections are more prominent than they are in the male. Several hairs are present dorsally and along the anterior, temporal and occipital margins.

From deep antennal sinuses arise the antennae, different in the two sexes. In the female the antennal segments, in order of decreasing length, are 3, 1 and 2 (Fig. 14). The second and terminal segments are of about equal diameter but the basal segment is one-quarter again as wide as either of the other segments. The segments are joined one to another in a more or less straight line.

In the male the antennae (Fig. 13) are longer than in the female. The basal antennal segment is more than two and one-half times wider than either of the other two segments. The second segment is but slightly wider than the third segment. The basal segment is almost twice as long as the second segment. Intermediate in length between the first and second segments is the third segment. The third segment terminates in a couple of heavy, broad and short spurs borne on the inner surface. Just basal to the spurs is a toothlike projection. Another projection arises between antennal segments 2 and 3. Whereas in the female the antennae were straight, in the male the antennae curve backward and inward.

The concave hind border of the male pterothorax bears about four bristles while in the female eight may be present.

The outline of the terminal eighth segment is different in the two sexes. The gonopods of the female project beyond the end



EXPLANATION OF PLATE VI

FIG. 11. Right half of head, antenna removed, male, dorsal aspect. FIG. 12. Right half of head, antenna removed, female, dorsal aspect. FIG. 13. Antenna, male, dorsal aspect. FIG. 14. Antenna, female, dorsal aspect. FIG. 15. Terminal abdominal segments, female, ventral aspect. FIG. 16. Adult, male, dorsal aspect. FIG. 17. Adult, female, dorsal aspect.

of the abdomen on either side of a deep median emargination. They cover the sternal surface and lie transversely across the end of the abdomen (Fig. 15). The male abdomen tapers to the anal extremity at which point the copulatory perputial sac is extruded. The suture joining segments VII and VIII is apparently absent in the adult male.

The dorsal chaetotaxy of the two sexes differ in that more hairs are present on the female abdomen. The first segment of the female abdomen is furnished with a transverse series of about ten bristles at its anterior margin medially. Along the posterior margin of the same segment a similar median group of hairs arises on each side of which there are about four more hairs. As many as ten hairs may be found along the lateral margins. Segments II to VI (inclusive) each bear a transverse row of about twenty-four to thirty-six hairs. Segment VII bears about ten hairs. Arising from the terminal segment are a central cluster of four dorsal bristles and a transverse series of four bristles.

A characteristic of the male abdominal setae is the separation of the median group of hairs on each of the first three or four segments into two groups. An anterior series of about seven hairs is present on segment I behind which a similar group arises. On each side of the posterior group are four bristles. Along the lateral borders are clusters of ten to sixteen hairs. Segments II to VI (inclusive) bear transverse series of about sixteen to twenty-four dorsal bristles with about six bristles present on segment VII. The terminal segment bears a terminal cluster of several hairs and a transverse series of four hairs.

The average total length of the male was 1.50 mm.; the female, 1.68 mm. In the male, the average length of the head was 0.42 mm.; the thorax, 0.16 mm.; the abdomen, 0.92 mm.; the average width at the widest part of the head was 0.58 mm.; the thorax, 0.49 mm.; the abdomen, 0.86 mm. In the female, the average length of the head was 0.46 mm.; the thorax, 0.16 mm.; the abdomen, 1.06 mm.; the average width at the widest part of the head was 0.63 mm.; the thorax, 0.55 mm.; the abdomen, 1.00 mm.

SUMMARY AND DISCUSSION.

In a study of the life history stages of the dog biting louse, *Trichodectes canis* (DeGeer), the following occurrences are recognized:

1. The abdomen of all immature instars of the louse and of the adult female is eight-segmented while the adult male abdomen is seven-segmented. However, the first segment is twice as long as

any of the remaining segments. In addition, the first abdominal segment bears two transverse rows of dorsal bristles whereas the other segments bear only one transverse row. Therefore, the apparent first abdominal segment is the true first and second abdominal segments which have fused prior to hatching. In the male, the apparent seventh segment is the true eighth and ninth segments, fusion of the apparent seventh and eighth segments taking place in the third molt.

2. On eclosion from the egg the nymph has a single pair of spiracles which is located on the prothorax. The appearance of a pair of spiracles on each of the abdominal segments II to VII (inclusive) occurs in the first molt.

3. There is an increase in the number of bristles on each instar after molting. This is especially true of the hairs on the abdomen. Each median transverse row of hairs on the abdominal tergites is continuous in all instars except in the adult male where the first three or four rows are separated into two groups.

4. The sex of immature instars of the louse is not distinguishable on the basis of external secondary sexual characteristics. The male and female copulatory apparatus are acquired in the final molt. At this same ecdysis, while the female antennae remain relatively unaltered, the male antennae undergo two important changes. First, the basal antennal segment swells greatly in size. Secondly, the terminal antennal segment acquires a pair of distal spurs plus two cuticular denticles. These morphological modifications probably enable the male to grasp the female during copulation.

ACKNOWLEDGEMENT.

This paper is from a thesis presented to the Graduate School of the Ohio State University in partial fulfillment of the requirements for the degree of Master of Science. The writer is indebted to Dr. Carl E. Venard who furnished the material for this study and otherwise offered helpful suggestions and advice during his supervision of the preparation of the thesis.

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**NEW OR INSUFFICIENTLY-KNOWN CRANE-FLIES
FROM THE NEARCTIC REGION (DIPTERA,
TIPULIDAE). PART X.¹**

By CHARLES P. ALEXANDER, Amherst, Mass.

The preceding part under this title was published in 1949 (Bull. Brooklyn Ent. Soc., 44: 15-20). At this time I am describing a series of species that were taken in Arizona by Mr. Floyd Werner, to whom I am indebted for materials from the Philippines, Mexico and the southwestern United States. The types of the species are preserved in my personal collection.

***Nephrotoma navajo* n. sp.**

Mesonotal praescutum yellow, with three black stripes, the lateral pair slightly outcurved; mediotergite chiefly black; antennae black, the scape a trifle paler; occipital brand elongate diamond-shaped; wings with a weak brownish tinge, the stigma pale brown; abdomen yellow, the tergites trivittate with brown, the median stripe nearly continuous; male hypopygium with the lateral tergal lobes broadly rounded; inner dististyle with beak compressed, dorsal crest low, elongate, lower beak terminating in a strong blackened spine; eighth sternite with caudal margin subtruncate, with sparse setae on the sublateral portions.

Male.—Length about 9.5-11.5 mm.; wing 10-11 mm.; antenna about 3-3.5 mm.

Frontal prolongation of head yellow, darkened above, including nasus, in cases only the outer end of prolongation darkened; palpi brownish black. Antennae black, the scape a trifle paler; flagellar segments moderately incised. Head light yellow on front and beneath, deep orange on vertex; a small brown spot on either side of vertical tubercle adjoining the eye; occipital brand elongate diamond shaped, sharp-pointed in front, in cases reaching the weak notch of the vertical tubercle.

Pronotum light yellow medially, infuscated on sides. Mesonotum polished yellow, the praescutum with three black stripes, the anterior ends of the lateral pair slightly outcurved, ending in a vague more opaque spot; lateral end of suture and a linear mark cephalad of this on the praescutal margin opaque black; scutum yellow, each lobe with two confluent polished black areas; scutellum testaceous

¹Contribution from the Department of Entomology, University of Massachusetts.

yellow, with an ill-defined central darkening; mediotergite chiefly black, the broad lateral margins light yellow except behind. Pleura light yellow variegated with dark reddish brown areas on the ventral sternopleurite, anepisternum, meron and pleurotergite, and again on the posterior margin of the mesepisternum. Halteres dark brown, the stem obscure yellow at base. Legs with the fore coxae darkened on basal half, the middle pair on extreme base only, the remainder of coxae weakly pruinose; trochanters yellow; femora obscure yellow, the tips narrowly but conspicuously blackened; tibiae brownish yellow, the tips more extensively blackened; tarsi black; claws (male) toothed. Wings with a weak brownish tinge, the prearcular and costal fields more yellowish brown; stigma pale brown; veins brownish black, those of the costal field paler. Venation: Cell M^1 narrowly sessile; $m-cu$ a distance before fork of M about equal to vein M_{1+2+3} or less.

Abdomen yellow, the tergites trivittate with brown, the median stripe nearly continuous, narrowly broken at the posterior margin of segment, lateral stripes broken into spots; sternites and hypopygium yellow. Caudal margin of ninth tergite of male hypopygium with a deep and narrow notch, the lateral lobes broadly rounded, the blackened spines relatively sparse and chiefly marginal; a small outer lobule that bears six or more similar spines. Outer dististyle of moderate length, narrowed gradually to the subacute tip. Inner dististyle with the beak compressed, darkened; dorsal crest low but elongate, glabrous; lower beak terminating in a strong blackened spine; posterior crest with a small reddish brown spine. Eighth sternite extensive, the caudal margin subtruncate or with the membranous median portion a trifle more produced; sublateral setae yellow, relatively sparse, forming weak brushes.

Habitat: Arizona (Apache County).

Holotype: ♂, McNary, White Mountains, altitude 7400 feet, July 22, 1948 (Werner). Paratopotypes, 4 ♂♂.

This fly most resembles species such as *Nephrotoma excelsior* (Bergroth), of mountainous British Columbia; *N. snowi* (Doane), of the Rocky Mountains; and *N. vittula* (Loew), of subarctic North America. It differs from all in the details of coloration, including the body, antennae, and wings, and in the hypopygial characters of those species where the male sex is known. The hypopygium of *excelsior* has not been described.

***Nephrotoma perincisa* n. sp.**

Mesonotum polished light yellow, the praescutum with three

reddish brown stripes that are more or less bordered by blackish; lateral praescutal stripes black, without an opaque spot at anterior end; antennal scape yellow, most of the flagellum black; occipital brand relatively broad, diamond-shaped, pointed at both ends; wings subhyaline to weakly tinted; stigma medium brown; male hypopygium with the caudal margin of tergite deeply incised, lateral lobes triangular, pointed at tips, with blackened spicules; inner dististyle without spinous points on disk or posterior border; each gonapophysis produced into two slender spines; apex of eighth sternite unequally trilobed, the median lobe long and slender, with sparse setae.

Male.—Length about 11–12 mm.; wing 12–13 mm.; antenna about 4.3–4.5 mm.

Frontal prolongation of head yellow, more reddened above; nasus elongate; palpi yellow. Antennae with scape yellow; pedicel and base of first flagellar segment light brown, the remainder of organ black; flagellar segments moderately incised, longer than the verticils. Front light yellow, remainder of head orange; occipital brand diamond-shaped, relatively broad, pointed at both ends; vertical tubercle entire, rounded.

Pronotum light yellow above, more reddened on sides. Mesonotum polished light yellow, the praescutum with three reddish brown stripes that are more or less bordered by blackish, in the type much paler than in the paratypes; lateral praescutal stripes straight, without an opaque spot at anterior end; scutum yellow, each lobe patterned with reddish areas that are margined with black, the mark continued laterad along the suture and for a short distance caudad along the outer margin of lobe; median area of scutum with a narrow dark line; scutellum dark reddish brown, parascutella somewhat paler, in cases yellow; mediotergite with its central portion reddish brown, the lateral borders broadly yellow; pleurotergite reddish, the swollen portion more yellowed. Pleura yellow, variegated on ventral sternopleurite and anepisternum with pale reddish areas, the mesepimeron and meron uniformly pale. Halteres with stem obscure yellow, knob infuscated. Legs with the coxae whitish pruinose; trochanters yellow; remainder of legs brownish yellow, the tarsi blackened; claws (male) toothed. Wings subhyaline to weakly tinted, cell *Sc* brownish yellow; stigma medium brown; veins brown. Sparse macrotrichia in centers of outer parts of cells *R*₃ and *R*₅; stigmal trichia numerous. Venation: *Sc*₂ ending a short distance beyond the origin of *R*₅; cell *M*₁ short-petiolate; *m-cu* on *M* a short distance before the fork.

Abdomen chiefly yellow; tergites with a broken brown central stripe, interrupted at the incisures, including the basal ring of the segment, on the outer segments a little more expanded; tergites eight and nine, and all sternites, yellow. Male hypopygium with the caudal margin of the ninth tergite deeply incised, the lateral lobes triangular, pointed at tips, provided with blackened spicules. Outer dististyle long-oval, less than four times as long as broad, the tips narrowly obtuse. Inner dististyle with the beak narrow, its tips obtuse, slightly decurved; dorsal crest low in front, becoming more elevated behind, the posterior end truncated; lower beak slender, blackened, slightly upcurved at tip; no spinous points on disk or posterior part of style. Gonapophysis produced into two slender spines. Eighth sternite extensive, narrowed outwardly, the apex unequally trilobed, the median lobe long and slender, with sparse setae, the lateral lobes low and broad, with dense but relatively short incurved setae.

Habitat: Arizona.

Holotype: ♂, McNary, Apache County, White Mountains, altitude 7400 feet, July 22, 1948 (Werner). *Paratopotype*: 1 ♂; *paratype*: 1 ♂, west slope of Graham Mountains, Graham County, altitude 9000 feet, August 5, 1948 (Werner).

The present fly is superficially most like *Nephrotoma ferruginea* (Fabricius) and *N. occidentalis* (Doane), differing from all regional species in the structure of the male hypopygium.

Limonia (*Dicranomyia*) *geronimo* n. sp.

Belongs to the *tristis* (*liberta*) group; general coloration gray, the praescutum with a single conspicuous brown stripe; male hypopygium with the tergite broadly truncated across apex, the median area with a group of seven or eight long setae; ventral dististyle relatively small, its total area about one-half greater than that of the basistyle; rostral prolongation with the tubercles of the spines small, the largest about one-half the length of the spine, the second tubercle at its base, very small.

Male.—Length about 7.5 m.; wing 8 mm.

Rostrum and palpi black. Antennae black throughout; scape more pruinose; flagellar segments oval; verticils relatively short and inconspicuous. Head light gray; anterior vertex narrow, approximately one-half the diameter of the scape.

Pronotum dark brownish gray. Mesonotal praescutum gray, with a single conspicuous brown stripe, the lateral stripes not or barely indicated; posterior sclerites of notum and the pleura gray;

dorsopleural membrane restrictedly obscure yellow. Halteres with stem yellow, knob infuscated. Legs with the coxae brownish black, pruinose; trochanters obscure brownish yellow; remainder of legs black, the femoral bases restrictedly yellow. Wings relatively narrow, whitish subhyaline; stigma short-oval, pale brown, inconspicuous; veins dark brown, somewhat paler in the prearcular field. Venation: Sc_1 ending opposite the origin of R_s , Sc_2 close to its tip; R_s weakly angulated and spurred near origin; inner end of cell R_3 lying far before the other elements of cord; $m-cu$ about one-half its length before the fork of M .

Abdominal tergites dark brown, sparsely pruinose, basal sternites somewhat paler; male hypopygium darkened, the ventral dististyle chiefly pale. Male hypopygium of the general type of *liberta*. Ninth tergite broadly truncated across apex, the median area with a group of seven or eight long yellow setae. Basistyle with the tubercles about as in *liberta*; ventromesal lobe with a large area of strong setae at and near tip. Dorsal dististyle only slightly curved, the tip abruptly narrowed into a sharp spine. Ventral dististyle relatively small, its total area about one-half greater than that of the basistyle; rostral prolongation with the tubercles of the spines small, the largest about one-half the length of the spine, the second tubercle at its base, very small. Gonapophysis with the lower edge of the lobe microscopically and irregularly serrulate or roughened.

Habitat: Arizona (Cochise County).

Holotype: ♂, West slope of the Chiricahua Mountains, altitude 5640 feet, August 3, 1948 (Werner).

Closely related to *Limonia* (*Dicranomyia*) *liberta* (Osten Sacken), of eastern North America, differing especially in the structure of the male hypopygium.

Atarba (Atarba) apache n. sp.

Thoracic dorsum fulvous yellow, the posterior sclerites vaguely pruinose; antennae with scape yellow, the flagellum uniformly black; femora obscure yellow basally, the tips broadly and gradually infuscated; wings brownish yellow; Sc_1 ending about opposite one-fourth the length of R_s .

Female.—Length about 7 mm.; wing 7.5 mm.

Rostrum obscure yellow; palpi black. Antennae with scape yellow, pedicel brownish testaceous, flagellum uniformly black; flagellar segments long-oval to subcylindrical. Head dark gray, somewhat more reddened posteriorly.

Thoracic dorsum chiefly fulvous yellow, the central part of the scutum and mediotergite vaguely to sparsely pruinose. Pleura obscure yellow, sparsely pruinose. Halteres weakly infuscated, the base of stem narrowly more yellowed. Legs with the coxae and trochanters yellow; femora obscure yellow basally, the tips broadly and gradually infuscated, more extensive on the fore legs where about the outer three-fourths is darkened; tibiae brownish yellow, the tips darker brown; tarsi brownish black. Wings brownish black, the prearcular field more yellowed; cells *C* and *Sc*, with the stigma, weakly infuscated; veins *R*₅ and *Cu* brownish yellow, the other veins pale brown, darker in the costal field. Venation: *Sc*₁ ending about opposite one-fourth the length of *R*₅, *Sc*₂ some distance from its tip, placed a short distance before origin of *R*₅; *R*₅ weakly angulated at origin, about one-third longer than the basal section of *R*₅; branches of *R*₅ subparallel on basal half, thence diverging, particularly *R*₅, cell *R*₄ at margin about one-third or more longer than cell *R*₂; *m-cu* close to fork of *M*.

Abdomen dark brown, only the genital segment and bases of ovipositor yellow; cerci elongate, horn-colored.

Habitat: Arizona.

Holotype: ♀, McNary, Apache County, White Mountains, altitude 7400 feet, July 22, 1948 (Werner).

This very distinct fly is most nearly allied to certain Mexican species, including *Atarba* (*Atarba*) *mexicana* Alexander, differing in all details of coloration and venation. It is entirely distinct from the only other regional species, *A. (A.) wernerii* n. sp.

***Atarba* (*Atarba*) *wernerii* n. sp.**

Thoracic dorsum reddish yellow, unpatterned; antennae with scape and pedicel black; legs obscure yellow; wings pale yellow, the stigma not or scarcely indicated; abdomen obscure yellow.

Female.—Length about 6.5 m.; wing 6.6–6.7 mm.

Rostrum brown, pruinose on the sides; palpi darker brown. Antennae with scape and pedicel black, more or less pruinose; flagellum broken. Head gray pruinose.

Thoracic dorsum reddish yellow, unpatterned, the pleura somewhat clearer yellow. Halteres with stem yellow, knob weakly infuscated. Legs with the coxae and trochanters pale yellow; remainder of legs obscure yellow, the outer tarsal segments infuscated. Wings pale yellow, the stigma not or scarcely darkened; veins yellow. Venation: *Sc*₁ ending just beyond origin of *R*₅, *Sc*₂ a slightly greater distance before this origin; *R*₅ pale, without trichia, sub-

equal in length to the basal section of R_5 ; upper branch of R_s nearly straight, cell R_4 gently widened outwardly, approximately twice as wide at margin as cell R_2 ; $m-cu$ at fork of M .

Abdomen obscure yellow, the cerci darker.

Habitat: Arizona.

Holotype: ♀, Oak Creek Canyon, Coconino County, August 13, 1948 (Werner). *Paratopotype*: ♀.

I take very great pleasure in naming this distinct fly for Mr. Floyd Werner. The species is quite different from the three others now known from the United States and likewise from all regional Mexican species. The blackened basal segments of the antennae would seem to indicate that the flagellum would be similarly colored and not bicolored as in *Atarba* (*Atarba*) *picticornis* Osten Sacken and many other related forms.

Back Issues of the Society's Publications. During the past year the Society's stock of past issues of the **Bulletin** and **Entomologica Americana** has been rearranged so as to facilitate the prompt handling of orders. All orders for all publications **MUST** be sent **DIRECT** to Brooklyn Entomological Society, R. R. McElvare, Treasurer, 26 Bogart Avenue, Port Washington, New York.

PROCEEDINGS OF THE SOCIETY

MEETING OF DECEMBER 16, 1948

A regular meeting of the Brooklyn Entomological Society was called at the Brooklyn Museum on December 16, 1948 at 8.00 P. M. Five members and three visitors were present. The minutes of the October meeting were read and approved. Dr. Tulloch presented a brief report of the Publication Committee which was accepted. Messrs. Naumann, McElvare and Bucholz were named to the Nominating Committee by the president.

Mr. A. T. Gaul presented the evening's discussion "The Ecology of Deer Hill, Mass." giving an illustrated ecological survey of a typical Berkshire Hill. The geology, history and conservation practices were mentioned as well as the reptile, mammal, insect and plant life.

The meeting was adjourned at 9:45 P. M.

Respectfully submitted,

A. T. GAUL

MEETING OF JANUARY 13, 1949

A regular meeting of the Brooklyn Entomological Society was held at the Brooklyn Museum on January 13, 1949. President Tulloch called the meeting to order at 8:00 P.M. Six members were present.

The minutes of the preceding meeting were read and approved. The Treasurer's report for the year 1948 was accepted as read. Mr. Teale read the report of the Publication Committee which was accepted.

The Society discussed the matter of accepting membership from persons unsponsored by members. It was agreed that although many persons unknown to the membership may be potentially fine members, the by-laws would not be amended at this time.

Mr. Buchholz, reporting for the nominating committee, submitted the following slate of officers and committee members for 1949:

President—E. W. TEALE

Vice President—F. T. NAUMANN

Secretary—A. T. GAUL

Treasurer—R. R. McELVARE

Publication Committee

E. W. TEALE

J. C. BEQUAERT, Editor, *Entomologica Americana*

G. S. TULLOCH, Editor, *Bulletin*

Executive Committee

O. BUCHHOLZ

J. J. KELLNER

G. S. TULLOCH

Delegate to N. Y. Academy of Sciences

A. T. GAUL

It was moved and approved that the nominations be closed. The Secretary was instructed to cast one ballot to certify the election of the slate. At this point the chair was turned over to the new President, E. W. Teale.

The President then introduced the speaker of the evening, Mr. Otto Buchholz, who discussed his field trip into the South and through Texas.

In early March, 1948 Mr. Buchholz began an extensive automobile trip for the purpose of collecting Lepidoptera in southern and southwestern United States. Proceeding down the Atlantic coast, he made extensive collections in Georgia and Alabama. After a stopover in New Orleans, he continued into Texas and collected in the Rio Grande Valley area. Mr. Buchholz reported on the environmental features of the various areas visited as well as on the problems facing a collector in each of the areas.

The meeting adjourned at 9:40 P.M.

Respectfully submitted,

A. T. GAUL.

MEETING OF FEBRUARY 10, 1949

A regular meeting of the Brooklyn Entomological Society was held at the Brooklyn Museum on February 10, 1949. The meeting was called to order at 8:00 P. M. by vice-president F. T. Nauman. Six members and three visitors were present.

The minutes of the previous meeting were read and approved. Mr. McElvare read a report from Dr. Bequaert on the progress of *Entomologica Americana*. Dr. Tulloch proposed Mr. Charles Pomerantz, 20 Hudson St. N. Y. City for membership. It was moved and voted that the by-laws be suspended and that Mr. Pomerantz be immediately elected to membership.

Since Mr. Pomerantz was present, Dr. Tulloch called upon him to discuss some of his entomological activities. He spoke briefly on his work with ticks, the Oriental Rat mite, and other arthropod pests and disease vectors.

Because of the illness of the speaker of the evening, Dr. Tulloch volunteered to discuss malaria. He traced the life history of the malaria organism (*Plasmodium*) in man and in the mosquito, the the clinical types of malaria, and the several complexities in its cure and accidental transmission.

The meeting was adjourned at 9.45 P. M.

Respectfully submitted,

A. T. GAUL

BOOK NOTES

The Songs of Insects, with related material on the production, propagation, detection, and measurement of sonic and supersonic vibrations. By George W. Pierce. 329 pages, 243 figures. 1948. Harvard University Press. In England, Oxford University Press. (Price, \$5.00)

Entomologists are indebted to an Emeritus Professor of Physics at Harvard University for this scientific report on the mechanism and properties of insect stridulation. For twelve years Dr. Pierce studied the songs of some 38 species of New England Orthoptera, also two species of cicadas. Some were collected in the New Hampshire fields with the aid of instruments which detected stridulations of too high a frequency to be audible to human ears. The majority of species were studied while confined to cages, and motion pictures of many were taken while stridulation was in progress, sample frames being here reproduced. Acoustics apparatus capable of receiving even supersonic vibrations was set up in such a way that photosensitive paper made a record of all pulsations, and the frequency of sound vibrations was accurately determined. Temperature is well known for its importance in influencing the pulsations of certain species, but Dr. Pierce had an opportunity to observe the effect of temperature on only a few of the species studied. More information on the number of specimens tested per species would also have been appropriate, since variation in a series of individuals may prove to be significant. About one-fourth of the book is used to describe the methods and apparatus, and although the discussion is very clear and well illustrated, many of the formulae and procedures naturally can be comprehended only by an accomplished physicist. A few notes on bats and birds are included.

Entomologists will be interested in habitus photographs which represent nearly all the species studied, and in the photomicrographs of the stridulatory structures, which show "file" and "scraper" in detail. Individual wings and their stridulatory portions are illustrated for most species, and a report is given on the part that the unveined disklike areas play in wing resonance. Dr. Pierce found that three subspecies of *Nemobius fasciatus* could easily be distinguished by sound records, amply supporting B. B. Fulton's observations by ear of nearly 20 years ago. The song of each species is analyzed, noting the pulses per second in the chirp and the frequency of vibrations, and a graphic presentation is made of the chirping, reproduced directly from the apparatus that recorded it.

The study of orthopteran sounds previously received the attention of many keen observers. Scudder set the notes to supposed music, Allard described how the chirps sounded to him, giving many details of orthopteran behavior, and Fulton wrote a key to the identification of the singing Orthoptera of North Carolina based on the "songs" (*Jour. Elisha Mitchell Sci. Soc.* 47: 55-69, 1932). Both Aliard and Snodgrass have given clearly written resumes of the subject (*Smithsonian Rept. for* 1928: 563-591, 1929; *Ibid.* 1923: 405-452, 1925). The late Frank E. Lutz began studies of these sounds, aided by a collaborator equipped with modern acoustics apparatus, and a few other workers have made approaches to a technical excursion into this field. The thoroughness and completeness with which Dr. Pierce's work was done, coupled with his intimate understanding of the methods necessary for permanently recording the results, make his book unique and a monographic landmark in the study of insect sounds.—ASHLEY B. GURNEY, Falls Church, Virginia.

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No. 4

STUDIES ON THE PLECOPTERA OF NORTH
AMERICA: V. NOTES ON ISOGENOIDES.¹

By J. F. HANSON, Amherst, Mass.

Since the publication of a study on *Isogenoides* in The American Midland Naturalist in 1943, a new species has been discovered and a further study of *I. hudsonicus* Hanson has been conducted in view of the synonymy of this species under *I. frontalis* by Ricker.

***Isogenoides zionensis* n. sp.**

Fig. 3.

Coloration and structural details typical of *Isogenoides* as discussed in Part III of the author's American Midland Naturalist series.

Male.—Length of body, 13–17 mm.; wings 4–5 mm. long, brachypterous, extending only to fourth or fifth abdominal segment.

Abdominal segments 6, 7, and 8 with dorsolateral humps smaller than those of such species as *I. frontalis*. No nail present on 7th sternite. 9th sternite only very slightly produced backward, less so than in other known species of the genus. Genital lobes of 10th segment large, broadly rounded, with a tendency toward desclerotization anteriorly; covered with numerous short, fine setae which are interspersed with a few spine-like setae especially in the anterior apical region. Supraanal process elongate, flattened, curved forward, and mostly membranous apically; posterior sclerotized support tapering to a needle-like point and reaching apex of the supraanal process; anterior support branched near the middle of the supraanal process into three arms which extend only part

¹ Contribution from the Department of Entomology, University of Massachusetts, Amherst, Massachusetts; financially supported by a John Simon Guggenheim Memorial Foundation Fellowship.

way toward the apex of the supraanal process. Lateral stylets attached to base of supraanal process; with basal region strap-like and imbedded in membrane; with apical region free, blade-like, slightly longer than broad. Paragenital plates convex, well sclerotized, similar to those of other species of the genus. Subanal lobes moderately large, and partly covered with short setae.

Collection Data. Holotype male—Zion National Park, Utah, altitude 4500 ft., June 21, 1942 (C. P. Alexander). Paratopotypes—4 males, June 22, 1942. All types are in the Hanson collection.

This species resembles *I. elongatus* which is similarly brachypterous, which has rounded genital lobes, and sometimes has no discernible nail on the seventh abdominal sternite. However, the genital lobes of *I. elongatus* are narrower, its lateral stylets are much longer, and its supraanal process is greatly different in shape from that of *I. zionensis*.

***Isogenoides hudsonicus* Hanson**

Fig. 1.

1942. *Isogenus frontalis*, Frison, Bull. Ill. Nat. Hist. Survey Vol. 22, art. 2: 290–292, fig. 59 (in part).

1943. *Isogenoides hudsonicus* Hanson ♂ ♀, Amer. Midl. Nat. 29, no. 3: 662–663, figs. 7, 17, 18.

1944. *Isogenoides frontalis*, Ricker, Canad. Ent. 76: 181 (in part).

This species was recently synonymized by Ricker under *I. frontalis*. In my opinion, differentiation of the two species still remains essentially as discussed in the original description of *I. hudsonicus* and in the key except that two additional distinctive features have been discovered. This present study is based on a much greater number of widely collected specimens than either this author or Ricker had previously been privileged to study. They include all of the specimens of *I. frontalis* and *hudsonicus* known to be present in the United States National Museum (USNM), the Canadian National Collection (CNC), Cornell, and the Museum of Comparative Zoology at Harvard (MCZ) as well as some from the Illinois Natural History Survey Collection (INHS) and from Ricker's (WER) and my personal collection. To the curators of all of these museums I am deeply indebted for the loan of specimens and permission to clear and dissect them for critical study.

The following table shows, in order of relative importance, features which distinguish *I. hudsonicus* from *I. frontalis*.

Character	<i>hudsonicus</i>	<i>frontalis</i>
Shape of lateral stylets in dorsal view.	Tapered from base to apex.	Subcylindrical for most of length; much narrower at base of subcylindrical section than is stylet of <i>hudsonicus</i> at same distance from apex.
Distance of end of posterior sclerotized support from apex of supraanal process.	.16-.24 mm.	.28-.44 mm.
Angle on posterior margin of genital lobe just above cercus.	Present	Absent
Angle at "heel" of "foot" of genital lobe.	110-130 deg., generally 130 deg., infrequently much less.	Generally 90-110 deg., infrequently more.
Length of lateral stylets.	.22-.34 mm.	.28-.40 mm.

The above features are all clearly shown in Figures 3 and 7 in the author's previous publication on *Isogenoides* except perhaps for the lateral stylets which are shown in this paper (Figs. 1 & 2) at greater enlargement to illustrate the extremes of variation in shape. The first two criteria listed in the table distinguish, easily and without exception, all of the specimens of *I. frontalis* and *I. hudsonicus* that the author has studied. The differences between their supraanal processes can usually very easily be observed even without making actual measurements. The differences between the shapes of the lateral stylets of the two species is very marked. The relative slenderness of the lateral stylets of *I. frontalis* gives them the appearance of being much longer than those of *I. hudsonicus*, although actual measurement shows this to be an illusion due to shape in some cases. The shape of the genital lobes is a very convenient character to use, since it is easily observable even in most dried specimens. It is almost always very distinctive (Figs. 1D, 2D) although extremes of variation produce intermediates between the two species.

Further evidence of specific dissimilarity of *I. frontalis* and *I. hudsonicus* is offered by two factors indicating an unlikelihood of the existence of geographical variation and resultant intermediate forms. First, the entire known range of variation of any diagnostic character in either species may occur in any one locality. Sufficient series of specimens to demonstrate this have been available from widely separated localities (Ontario, British Columbia, and Michigan). Secondly, new distributional records show that their ranges overlap along the Athabasca River in Alberta and at least approximate each other near the Great Slave Lake and in northern Michigan and New York. This is significant since the two species are as easily distinguished in the coinciding or approximating habitats as they are in widely separated regions. It is noteworthy that these data still show the range of *I. frontalis* to extend into much warmer regions than that of *I. hudsonicus*. The fact that most northerly records are those of *I. frontalis* may at first seem to conflict with the above statement. However, as Porsild (1943) has shown for birds, numerous species extend farther north along the Mackenzie River than elsewhere in Canada.

The synonymy of *I. hudsonicus* under *I. frontalis* by Ricker is based on three contentions. First, he shows that intermediate conditions occur in the shape of the genital lobes; secondly he contends that all other diagnostic characters are even more variable than the genital lobes; and thirdly that all of these variations are geographical. Concerning the intergrading nature of the genital lobes of the two species Ricker is admittedly correct (Figs. 1C, 2C). His other two contentions, however, seem to be unfounded in fact. A careful restudy of the extremes of variation of the lateral stylets and supraanal process of the two species fails to disclose a single intermediate condition in spite of the fact that this study has included many more specimens than either of us has previously studied. It is also worthy of note that a large part of the collection data included in Ricker's references to *I. frontalis* refers to specimens which were pinned or preserved in alcohol with the genitalia retracted and therefore incapable of being studied for details of either supraanal process or lateral stylets. It appears that not even a single specimen of *I. hudsonicus* listed in Ricker's references (under *I. frontalis*) was when I first saw them (after he had published his conclusions), in a condition in which these latter structures could be studied. In his contention concerning geographical variation Ricker likewise makes definite reference only to the genital lobes. It is unfortunate that in studying this problem he did not

have access to a sufficiently large number of specimens to discover the real nature of their variability. As was discussed above, from material now available it is not possible to differentiate geographical variants since it can be shown that the entire range of variation of either species may be encompassed in any one locality.

It is true that *I. frontalis* and *I. hudsonicus* are very closely related. Intermediates may yet be discovered which show them to be a single species. However, in my opinion we are obliged by the distinctness of the two forms, as now known from many specimens from widely separated localities, to maintain them as separate species.

Through an abundance of correspondence I find that Ricker does not share my opinion, nor does he agree on observed details of shapes and measurements of specimens which we have both recently studied. The eventual settlement of this interesting problem will therefore undoubtedly await more extensive collecting and the opinions of a third party.

The following data supplement my previous records. They include references to specimens of *hudsonicus* listed under *I. frontalis* by Ricker (1944) and by Frison (1942). Frison's figures (1942) of *I. frontalis* undoubtedly represent *I. hudsonicus* as judged by his drawings of the supraanal process and the genital lobes and by the present writer's examination of specimens from Frison's plesiotype locality (Michigan).

1 male, Ungava Bay, H.B.T., Can. (L. M. Turner) (CNC). 1 male, Athabasca R. near Calling R., Alberta, Can., May 21, 1914 (F. Harper) (CNC). 2 males, 2 females, Churchill, Man., Can., July 9, 1936 (H. E. McClure) (INHS). 1 male, Hunt Creek, Montmorency Co., Mich., Aug. 30–Sept. 3, 1940 (J. W. Leonard) (INHS). 1 male, Platte R., Honor, Mich., May 27, 1939 (T. H. Frison & H. H. Ross) (INHS). 1 male, Muskrat Falls, Hamilton R., Labrador, Can., July 12–19, 1919 (S. E. Arthur) (CNC).

Isogenoides frontalis (Newman)

Fig. 2.

Collection data supplementary to those listed by Hanson (1943). 2 males, Grand Rapids and down the Athabasca R., Alberta, Can., May 24, 25, 1914 (F. Harper) (MCZ and CNC). 1 male, Newgate, B. C., Can., June 17, 1927 (A. A. Dennys) (CNC). 1 male, Aklavik, N.W.T., Can., June–July 1927 (R. T. & A. E. Porsild) (CNC). 2 males, S. Nahanni R., N. W. T., Can., Aug. 1928 (F.

Hunter) (CNC and WER). 1 male, Fraser R., Agassiz, B. C., Can., May 21, 1938 (W. E. Ricker) (WER). 1 male, Nechako R., Prince George, B. C., Can., July 13-15, 1938 (W. E. Ricker) (WER). 1 male, 1 female, Nechako R., Prince George, B. C., Can., July 13-15, 1938 (INHS). 1 male, Athabasca R. between Grand Rapids and Crooked Rapids, Alberta, Can., May 26-28, 1914 (F. Harper) (CNC). 1 male, West Branch, Mackenzie Delta, Can., July 15, 1924 (W. N. B. Hoare) (CNC). 1 male, St. Laurent, Sask., Can., May 13, 1939 (L. C. Paul) (CNC). 1 male, Near Ft. Yukon, Alaska (T. E. Winekoff) (USNM). 1 male, Ft. Yukon, Alaska (previously identified as *I. hudsonicus* by Hanson, 1943). 1 male, 1 female, Snake R., Idaho, May 22, 1932 (E. Kline) (INHS). 1 male, 1 female, Corvallis, Ore., March 19, 1934 (M. A. Scullen) (INHS). 1 male, 1 female, Corvallis, Ore., April 1, 1939 (D. Polson) (INHS). 2 males, 1 female, Vantage, Wash., July 5, 1932 (G. Hoppe) (INHS).

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EXPLANATION OF PLATE VII

Fig. 1. *Isogenoides hudsonicus* specimens from Churchill, Manitoba: lateral stylets and genital lobes. Fig. 2. *I. frontalis* specimens from British Columbia: lateral stylets and genital lobes. Fig. 3. *I. zionensis* n. sp. terminalia.

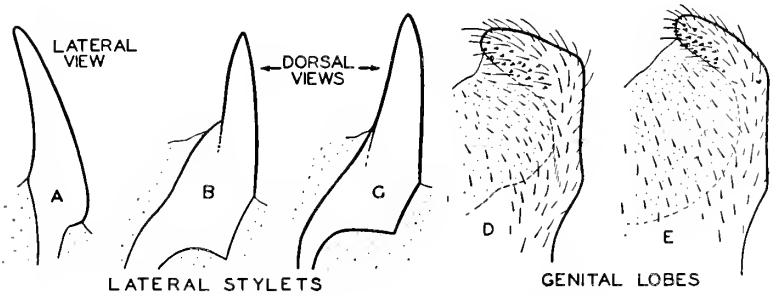


Fig. 1 *ISOGENOIDES HUDSONICUS*

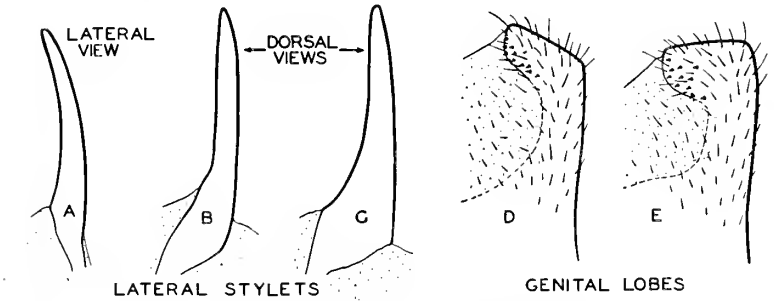


Fig. 2 *ISOGENOIDES FRONTALIS*

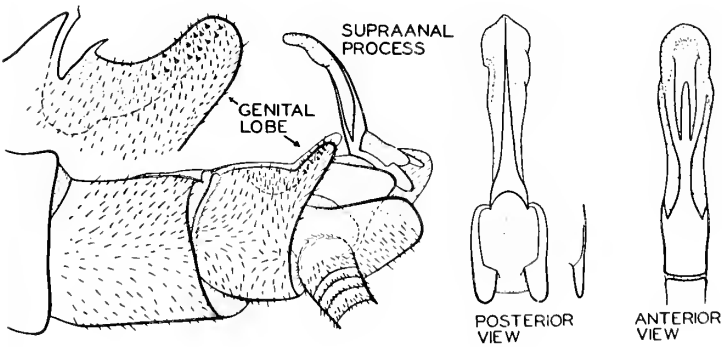


Fig. 3 *ISOGENOIDES ZIONENSIS*

**THE GENUS *PENESTIRELLUS* IN NORTH AMERICA
INCLUDING MEXICO (HOMOPTERA:
CICADELLIDAE).**

By DWIGHT M. DELONG and RUTH V. HERSHBERGER,
Columbus, Ohio.

The genus *Penestirellus* was described by Beamer and Tuthill¹ as resembling *Stirellus* but having two cross nervures between the sectors, with three antepical cells and without an appendix. Because of the two cross nervures these authors have indicated a relationship to Deltacephaloid genera citing especially *Polyamia* and *Latalus*.

Three Mexican species closely related to *catalinus* are described below. One of these, *pressus*, is composed of specimens which may or may not have two cross nervures and the others, *fumidus* and *fulvus*, are composed of specimens having only one cross vein. The heads of all three species are well produced. Furthermore, the genital structures are quite similar in type not only to each other but to *Stirellus obtutus* and related species. It would seem, therefore, that the two cross veins, when they occur, are not as significant as other characters and that *Penestirellus*, if a genus, is closely related to *Stirellus*.

Penestirellus catalinus was designated as the genotype.

***Penestirellus catalinus* Beamer & Tuthill**

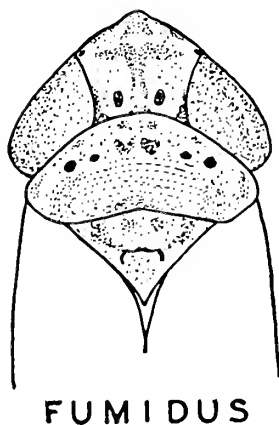
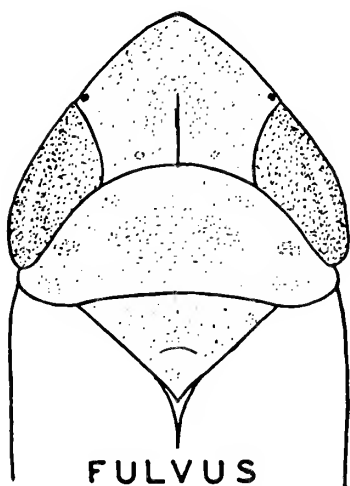
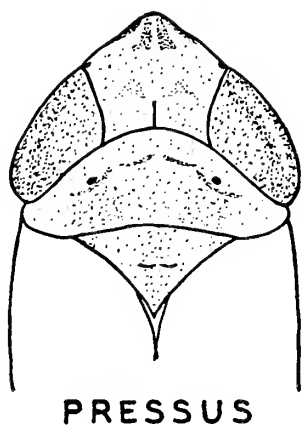
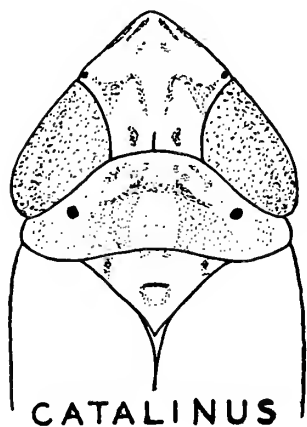
A dull yellowish species with pointed head and with dark brown markings. Length 3-4 mm.

Vertex rather sharply pointed, one-third longer at middle than basal width between the eyes at base.

Color: Vertex straw yellow with dark arcs from front showing on each side between eye and apex. A brown, waved, interrupted line between eyes which is interrupted at middle by ends turning backward on disc. A pair of spots on base of disc. Pronotum with a transverse row of spots across disc. Elytra with pale veins except apical veins which are brown. A brown spot on outer clavus, a brown spot on disc and a spot at tip of clavus also brown. Face pale brown with dark brown arcs.

Female seventh sternite black, broadly, roundedly excavated about half way to the base. Male valve triangular, three-fourths as long as basal width. Plates pointed at apex exceeding valve by

¹ Jour. Kansas Ent. Soc. 7: 21, 1934.



EXPLANATION OF PLATE VIII

Dorsal view of head, Pronotum and scutellum of species of *Penestirellus* as labeled.

less than half the length of the valve. Style constricted and narrowed at half its length, the apical fourth further constricted to form a finger-like tip. The aedeagus is slender, curved dorsally, with an enlarged basal portion extending dorsally.

This species was described from specimens collected at Sabina Canyon, Nogalis and Patagonia, Arizona. It has not been recorded for other states.

***Penestirellus pressus* n. sp.**

Resembling *catalinus* in form and general appearance but with a blunter head, greenish in color, unmarked, and with male aedeagus longer. Length 3.5–4 mm.

Vertex produced, bluntly angled, about one-fifth longer at middle than basal width between the eyes. Elytra usually with only one cross vein between the two sectors.

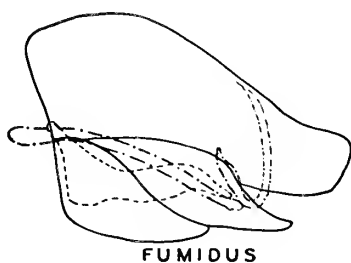
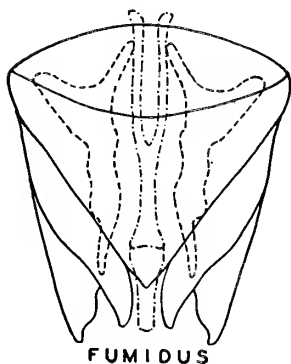
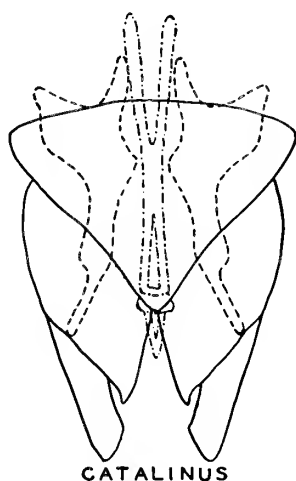
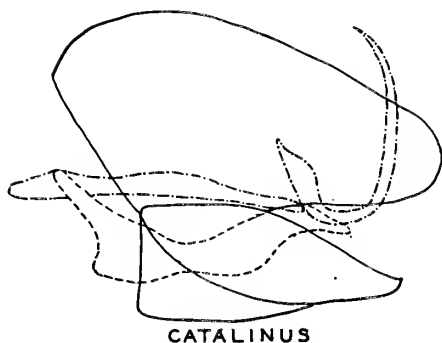
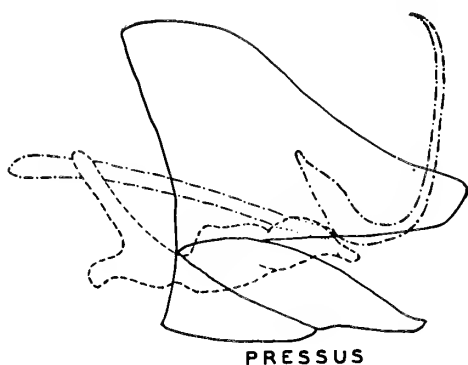
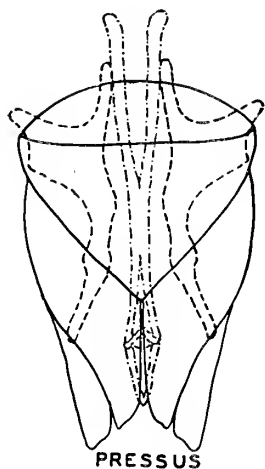
Color: Green tinged with yellow. Vertex and scutellum often yellowish. Disc of pronotum and elytra dull green. Face brownish.

Female seventh sternite broadly excavated from the prominent lateral angles to about one-half its depth, often with a rounded notch at middle. Male valve angularly produced, not quite as long as basal width. The plates exceed the valve by less than its length. The apices are bluntly pointed. The style is long, narrowed at about the middle to less than half its width, then produced after a slight enlargement to a long, narrow, finger-like apex. The aedeagus has an enlarged, upturned base beyond which it is narrowed, curved apically and produced to form a long, slender, erect terminus which is curved slightly anteriorly at the pointed apex. Pygofer greatly narrowed at apex.

Holotype male collected at Mexico City, D. F., Mexico, 18 kilometers west, September 1, 1939 by D. M. DeLong. Allotype female taken at Taxco, Guerrero, Mexico October 26, 1941 by Good and DeLong. Male paratypes are from Mexico City as above and Taxco. Female paratypes are from Acapulco, Guerrero, Mexico, September 10, 1939, Plummer and DeLong; Jiutepec, Morelos, Mexico, September 6, 1939, Plummer, Baker and DeLong; Mexcala Buena Vista, Guerrero, October 22 and 23, 1941, Good and DeLong; Zamora, Mich., Mexico, October 2, 1941, Caldwell, Plummer, Good, and DeLong.

EXPLANATION OF PLATE IX

Ventral and lateral views of male genital structures of species of *Penestirellus* as labeled, as viewed in position in abdomen.



***Penestirellus fumidus* n. sp.**

Resembling *pressus* in general form but smaller with a blunt head and brownish in color. Length, male 2.5 mm.

Vertex bluntly angled, a little longer at middle than basal width between the eyes. Vertex same length as pronotum.

Color: Pale brown marked with dark and black. Vertex pale brown with a dark brown transverse waved line or band between the anterior margins of the eyes. These are connected to a pair of basal spots by median longitudinal line. Pronotum with a row of six dark brown spots across the disc parallel to the anterior margin. Scutellum with a dark spot in each basal angle. Elytra pale brownish, veins pale on anterior two-thirds, dark brown on apical portion. Face brownish with dark brown arcs on each side.

Male valve triangular, more than half as long as basal width. Plates exceeding valve by about one-fourth its length. Style long, slender; the apical third narrow, finger-like in appearance. The aedeagus is rather narrow, produced dorsally to margin of pygofer, pointed at apex. The base is upturned and thickened.

Holotype male collected at Taxco, Guerrero, Mexico, October 26, 1941 by Good and DeLong. Paratype males collected at Zamora, Mich., Mexico, October 2, 1941 by Plummer, Caldwell Good and DeLong; and Puente de Ixtla, Morelos, Mexico, October 21, 1941 by Good and DeLong.

***Penestirellus fulvus* n. sp.**

Resembling *pressus* in general form but more robust and pale brown in color. Length, female 4 mm.

Vertex produced, blunt at apex, about one fourth longer at middle than basal width between the eyes. Vertex a little longer than pronotum, flat. Elytra short and broad, exposing the last two abdominal segments and ovipositor.

Color: Pale brown without markings except small brown spots on apical cells of elytra. There is a distinct brown spot on inner apical cell and a spot on the vein separating the outer apical cell from the costal area. Face pale brownish without arcs.

Female seventh sternite broadly, concavely excavated, the median posterior margin darker.

Holotype female and female paratype collected at Saltillo, Coah., September 23, 1941, by Caldwell, Good and DeLong.

Although no males are available for study, this species apparently belongs to *Penestirellus*, and it seems advisable to describe it at this time.

LARVAL DESCRIPTION AND TRANSFER OF THAUMAPHRASTUS KARANISENSIS FROM COLYDIIDAE TO A NEW SUBFAMILY OF DERMESTIDAE (COLEOPTERA)

By W. H. ANDERSON, Washington, D. C.

This interesting blind, wingless beetle was described by Blaisdell (1927) from a single incomplete and broken specimen that was removed from a plant gall. The gall had been buried for approximately 1700 years in the ruins of Karensis, a Greco-Roman town near the present-day Kom Washim, Fayoum Province, Egypt. Dr. Blaisdell realized that the species was an anomalous one. He did not assign it to any family, partly because the posterior tarsi were missing. However, he indicated that there might be some similarities, although only superficial ones, to *Aglenus*, in the Colydiidae. The beetle was catalogued in that family in the Zoological Record for 1927 (Insecta, p. 177). Except for being listed "Incertae sedis" in the Colydiidae by Hetschko (1930) no further references to the species in literature can be found under the name *Thaumaphrastus*.

In 1937 living specimens of the species were collected in a rice mill at Bay City, Tex., by A. I. Balzer, who was investigating insect pests of stored grains for the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture. The specimens were identified by H. S. Barber and W. S. Fisher, of that Bureau, by comparison with the fragments of the female type upon which the original description was based. Barber and Fisher informed Balzer of the importance of his discovery and urged him to collect further specimens and obtain immature stages if possible. Mr. Balzer kindly bred the species on a mixture of corn, wheat, and rice flour to which commercial meat scrap had been added. Subsequently he sent numerous adults and two larvae, which have been placed in the collections of the U. S. National Museum.

As indicated above, the incompleteness of the original specimen prevented Blaisdell from making a positive assignment of the species to any family, and he assigned it to the Clavicornia rather than to the Serricornia only with some evident hesitation. As is sometimes the case in difficulties of this nature, however, the characteristics of the larva, or at least the relative importance assigned to them, indicate clear-cut affinities with an established group of Coleoptera. In this case there seems to be no doubt that the larva is related to the larvae of the Dermestidae, particularly

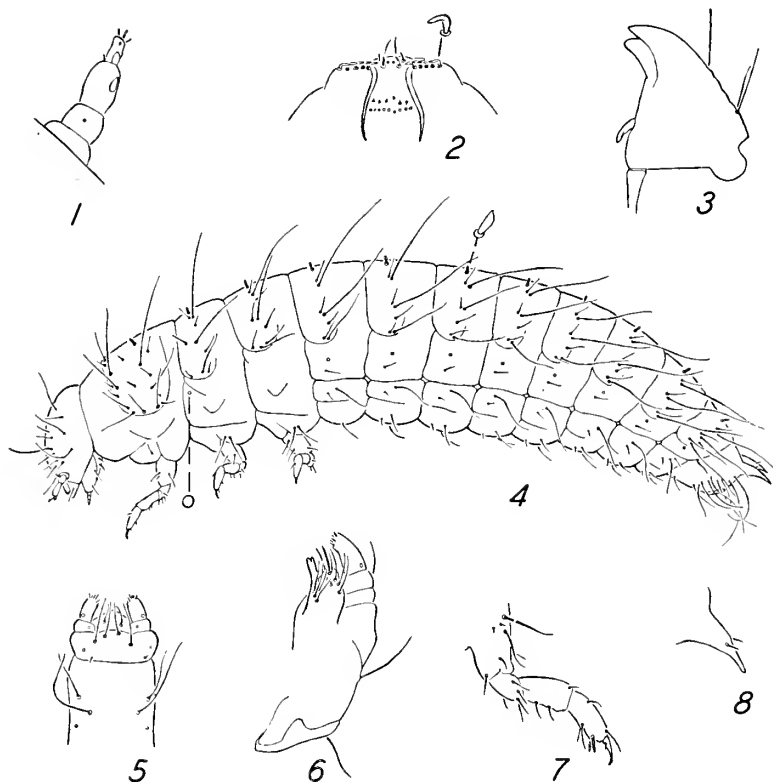
of the genus *Dermestes*.

This paper has been prepared to point out these similarities, as well as the differences between larvae of the Dermestidae and the larva of *Thaumaphrastus*. It seems advisable at the same time to include drawings of the adult beetle and certain details of its structure, together with some remarks on the bearing of these details on the proper placement of the species. The figures published by Blaisdell were of necessity drawn from fragments, and therefore may not give more than a general idea of the appearance of the perfect insect. By including the drawing of the adult it is hoped to make the species more readily recognizable. Possibly the species should be known under some prior name, catalogued in some other family.

Although described from Egypt, the species has a wide distribution and very likely is cosmopolitan. It may be carried in commerce. In addition to specimens from Bay City and Beaumont, Tex., where the rearing was done, there are specimens in the collections of the U. S. National Museum from Lincoln County, Nebr., found in a peach orchard; from Mexico (without further locality) associated with rice; and from India, intercepted with sweet potatoes in quarantine at New York City. If occurrence in flour mills may be included in the habits of the species, one may expect it to be abundant at times. Its apparent scarcity in collections could be explained by both the small size and the probable confinement to dark, secluded places.

The principal characteristics by which the larva of *Thaumaphrastus* is to be recognized are as follows:

Body (fig. 4) with simple setae, i.e., not spinulate or hastate, one pair near middorsal line on each thoracic segment and abdominal segments I to VIII short, clubbed; head free; epicranial and frontal sutures present; antenna (fig. 1) consisting of three articles, the penultimate article with apical, subconical, accessory sensory appendage; labrum free, its anterior margin slightly produced in the middle; epipharynx (fig. 2) with a short series of sharply curved setae on anterolateral margin; epipharynx, near middle, with a transverse series of about six minute setae and immediately behind these a transverse row of minute sensory pores; labral rods moderately long, in the shape of a sigmoid curve; mandible (fig. 3) with two apical teeth, with slender retinaculum, without basal tuft of setae; maxillary palpus (fig. 6) consisting of three articles; lacinia with an elongate, curved, apically bifid spur; maxillary articulating areas not large and cushioned; labial palpus



THAUMAPHRASTUS

EXPLANATION OF PLATE X

Thaumaphrastus karanisensis Blaisdell—larva. (Figures drawn by author.) Fig. 1, Antenna. Fig. 2, Epipharynx. Fig. 3, Mandible. Fig. 4, Larva. Fig. 5, Labium. Fig. 6, Maxilla. Fig. 7, Leg. Fig. 8, Urogomphus.

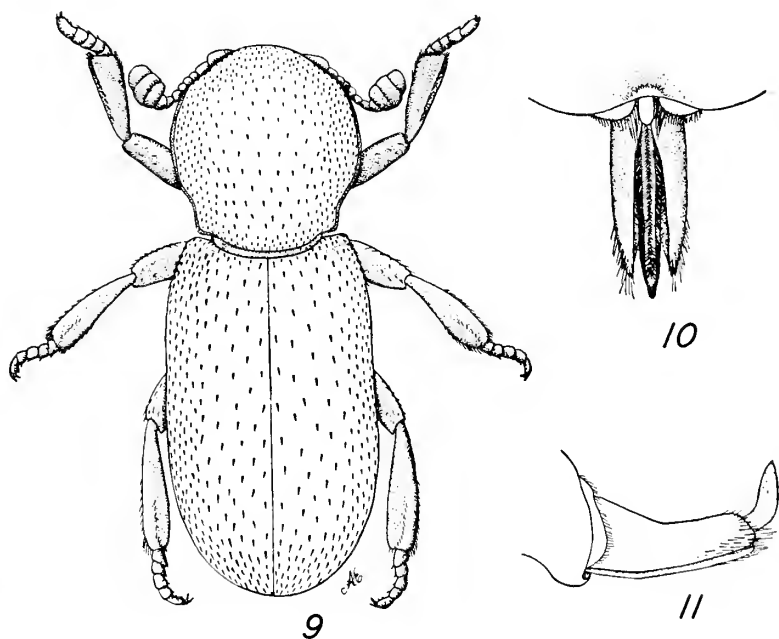
(fig. 5) consisting of two articles; gula present; legs (fig. 7) consisting of five articles, the tarsus and claw fused into a single claw-shaped, tarsungulus; spiracles simple, subcircular; abdominal segment X short, membranous, consisting mostly of lobes around anus; urogomphi (fig. 8) present, solid, slightly decurved.

Length of larger larva studied: 2.0 mm.

As stated previously, the larva of *Thaumaphrastus* bears many resemblances to larvae of the Dermestidae. A comparison of the diagnosis given above with that published by Rees (1943) for the dermestids will show this to be the case. The similarities which seem to be most significant, because they are diagnostic for dermestid larvae, are found in the general configuration of epipharynx and the bifid spur on lacinia. There is at least a vague similarity between *Thaumaphrastus* and *Dermestes* in the arrangement of the setae on the abdominal tergites. Rees (1947) states that *Dermestes* larvae have eight distinct oblique rows of setae on each abdominal tergite, i.e., four rows on each side of the middorsal line. Although there are no distinct rows of setae on the tergites of *Thaumaphrastus*, the setae tend to be in four groups on each side of the middorsal line.

The larva of *Thaumaphrastus* differs from larvae of the Dermestidae, as characterized by Rees, in the following features: setae on body simple, setae on anterolateral margin of epipharynx not broader toward the middle line, and labral rods curved toward each other posteriorly. Of these characteristics the difference in the shape of the setae on the body appears to be the most significant. However, it should be pointed out that Rees did not know the larva of *Orphilus*, which according to the description and figures published by Paulian (1943) has only simple setae. If *Orphilus* is correctly placed in the Dermestidae, the importance of the shape of the setae as a diagnostic character is lessened. We are left, then, with no characters that prohibit the inclusion of *Thaumaphrastus* in the Dermestidae.

Since the larva of *Thaumaphrastus* shows such strong affinities with larvae of the Dermestidae, particularly *Dermestes*, it will be appropriate to compare, briefly, the characters of the adults. It is not the purpose of the present discussion to make an exhaustive comparative study, but rather to point out the more obvious similarities and dissimilarities. At first glance the adults of *Thaumaphrastus* (fig. 9) do not appear to bear even a superficial resemblance to those of the Dermestidae. The adults of the latter, as characterized by Hinton (1945) are usually compact and



THAUMAPHRASTUS

EXPLANATION OF PLATE XI

Thaumaphrastus karanisensis Blaisdell—adult. (Figures drawn by Miss Addie M. Egbert.) Fig. 10, Dorsal view. Fig. 11, Aedeagus, ventral view. Fig. 12, Aedeagus, lateral view.

strongly convex beetles, nearly always with a dense vestiture of hairs or scales. The legs can be more or less completely retracted, and the hind coxae are somewhat transverse and excavated for the reception of the femora. Adults of *Thaumaphrastus* are not compact, and only weakly convex, with a rather sparse, fine hairlike vestiture. The legs cannot be effectively retracted, and the hind coxae are not transverse and not excavated to receive the femora. Eyes are absent, as are also the hind wings, the latter being present in all known dermestids except in females of the degenerate *Thylo-drias*. However, adults of *Thaumaphrastus* possess the following characters found in at least some dermestids: head somewhat deflexed; antenna consisting of eleven articles, the last three of which form an abrupt, compact club; maxillary palpus consisting of three articles; inflexed ventral sides of pronotum with an oval impression for the reception of the antennal club; elytra entire; five visible abdominal sternites; front coxae contiguous, the coxae cavities open behind; hind femora with a readily discernible, but shallow, ventral groove for the partial reception of the tibiae; all tarsi consisting of five articles, the tarsal claws simple. In addition to the above-mentioned characteristics, the structure of the male aedeagus should be noted. The aedeagus (figs. 10, 11) is typically dermestoid, being practically identical in basic structure with that of some species of *Dermestes*, with well-developed, subparallel, lateral lobes and the median lobe strongly hook-shaped terminally, the hook directed dorsad, the orifice ventral and subterminal.

Although the lack of eyes and of hind wings are striking characteristics, neither can be considered as being of much significance beyond indicating a state of degeneracy. In widespread groups of Coleoptera either or both of these evidences of degeneracy have been accepted as being of no particular taxonomic significance. It appears, then, that the most tangible differences between *Thaumaphrastus* and the dermestids are found in the general habitus, in the correlated condition in which the legs are elongate and can not be retracted effectively, and in the vestiture. Because of my faith in the importance of larval structure and the preponderance of other characters, principally the structure of the male genitalia, held in common by adults of *Thaumaphrastus* and *Dermestes*, I am inclined to dismiss the observed differences in vestiture and habitus with the accompanying adaptations as being of no great consequence, and to conclude that the species is related to the Dermestidae, particularly to *Dermestes*. How close a relationship shall be indicated is, of course, a matter of individual opinion. The

dermestids form a group which is readily definable on larval characters of the adults as well. The inclusion of *Thaumaphrastus* in the family would not impose difficulties in characterization on larval structures, especially if *Orphilus* were continued in the *Dermestidae*. From the standpoint of the adults, the inclusion of *Thaumaphrastus* would present no more difficulties than does the inclusion of *Thylodrias*. It seems quite permissible, therefore, to consider *Thaumaphrastus* as belonging in the *Dermestidae*.

In the belief that a subfamily should be a more homogeneous group than is essential for a family, it would be desirable not to include *Thaumaphrastus* in the *Dermestinae* but to consider it as constituting a separate subfamily. The erection of a new subfamily of the *Dermestidae*, the *Thaumaphrastinae*, therefore, is proposed to include the single species *Thaumaphrastus karanisensis* Blaisdell. The new subfamily is considered to be most closely related to the *Dermestinae*, being separated from the latter by the vestiture, the structure of hind coxae, the lack of eyes and hind wings as imaginal characters, and the simple setae and the absence of a basal brush of setae on mandible as larval characters.

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**STUDIES ON THE COTTON JASSID (*EMPOASCA
DEVASTANS* DIST.) IN THE WEST PUNJAB: VIII.
EFFECT OF RAINFALL AND HUMIDITY ON
THE INCIDENCE OF JASSID ATTACK.**

By MOHAMMAD AFZAL and M. A. GHANI
Cotton Research Laboratory, Lyallpur, Pakistan

INTRODUCTION

The cotton jassid (*Empoasca devastans* Dist.) is a serious pest of American cottons in the West Punjab. The intensity of attack of this pest varies from year to year and during years of heavy infestation serious losses are inflicted to the cotton crop of the Province. An attempt was made to find out the climatic factors which may have some influence on the incidence of jassids. With this point in view the preliminary studies, reported herein, were undertaken.

It may be mentioned here that almost all the workers on this pest have observed annual fluctuations in the severity of jassid attack and some of them also have ascribed reasons for these variations. Peat (1928) working in Rhodesia observed that the incidence of the pest increased in the end of March after the rains and then decreased with the senility of the plants in May. Parnell (1934) noticed in South Africa that the jassid attack was worst after heavy rains. Sloan (1938) came to the conclusion that, in Queensland, a severe attack of jassids was associated with cloudy weather and undue sappy growth of American varieties of cotton. Prentice (1940) noticed that, in Tanganyika, heavy rains herald the real attack of jassids. Peat (1943) has observed that the jassids were unimportant in districts of Tanganyika where rainfall was low and that the jassid damage seemed to be linked up with wet years.

It will be seen from the foregoing that the effect of climatic conditions, particularly, that of rainfall on the incidence of jassid attack, has been noticed by many workers but no attempt appears to have been made to study the correlation of these two factors. It was, therefore, decided to find out if there existed any correlation between meteorological factors, such as temperature, humidity and rainfall and the intensity of jassid attack.

THE DATA

The records of jassid census are available in the Cotton Research Laboratory for nine years. The method of jassid census has been previously dealt with in detail (Verma and Afzal, 1940). The average jassid infestation throughout the season was calculated by transforming the data to $\log (n+1)$ (Williams, 1937) for one variety (289F/43), which was under trial in all these nine years. The figures so obtained have been designated as the "Jassid index." The average mean temperature, humidity and total rainfall was taken for the jassid season, i.e., from June 1 to November 1. These data are given in Table I.

TABLE I
"Jassid Index" and climatic conditions

Year	"Jassid Index"	Average Mean Temperature	Average Relative Humidity	Total Rainfall
1937	1.8219	88.8	53.2	5.70
1938	1.1977	88.0	55.2	5.80
1939	1.3086	89.2	54.8	5.60
1940	1.7342	88.6	58.6	3.40
1941	2.1088	88.3	63.8	12.11
1942	1.8274	86.9	65.6	12.04
1943	1.9837	88.1	63.2	9.87
1944	2.2134	86.3	70.2	10.80
1945	2.3741	87.5	68.7	10.87

The weakness in taking the average figures of temperature and humidity is realized as it is within the limits of possibility that an unusually hot day may kill a very large number of jassids. Such an occurrence, however, is not a common phenomenon during the period of severe attack of the pest. The population usually increases in the normal geometric ratio. Again the meteorological records are from the Stevenson's Screen and, therefore, do not depict the microclimate in which the nymph lives. As a preliminary attempt, however, at finding out the association of a pest with climatic factors, the present study is useful.

RESULTS

(1) *Average mean temperature.*

It is quite evident from Table I that there was no apparent association between "Jassid Index" and the average mean tem-

perature. This factor was, therefore, discarded and will not be considered any further.

(2) *Average relative humidity and total rainfall.*

The simple correlations between "Jassid Index" and relative humidity and rainfall were worked out and these are given below:—

"Jassid Index" and relative humidity

$$r = +0.813978 \quad \text{Highly significant}$$

"Jassid Index" and rainfall

$$r = +0.685762 \quad \text{Highly significant}$$

Both these correlations were positive and statistically significant at 1 percent level. This shows that "Jassid Index" increased with the increase in humidity or rainfall.

The multiple correlation between "Jassid Index," relative humidity and rainfall was found to be $r = 0.8145$, which is again statistically significant at 1 percent level. However, in order to work out the real association between "Jassid Index" and humidity and rainfall, partial regression equation was fitted to the data. This equation is given below:—

$$J. I. = 1.172005 + 0.048185 H + 0.005995 R$$

where J. I. = "Jassid Index,"

H = Average relative humidity, and

R = Total rainfall for the jassid period.

It may be added that partial correlation coefficients were individually non-significant. These are, however, given below:—

Partial correlation coefficient between "Jassid Index" and humidity keeping rainfall as constant = 0.603819 Non-significant

Partial correlation coefficient between "Jassid Index" and rainfall keeping humidity as constant = 0.049785 Non-significant

This shows that rainfall or average relative humidity alone had no effect, but, as the multiple correlation was significant, both these factors acting together affected the "Jassid Index" which may be termed as the rate of jassid multiplication.

The values of "Jassid Index" were calculated from the partial regression equation given above, and the calculated values along with the original values from Table I are given in Table II. These, along with average mean temperature, average relative humidity, and total rainfall for the jassid period have been graphically represented in Figure 1.

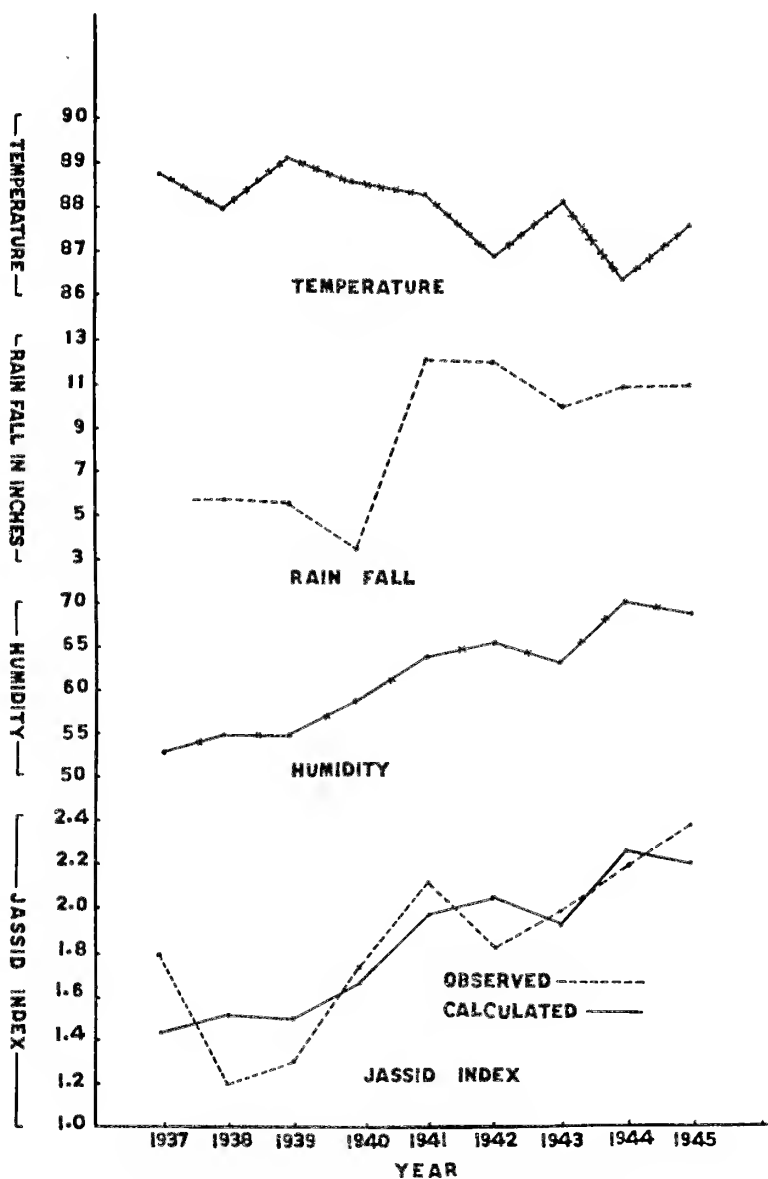


FIG. I JASSID INDEX AND CLIMATIC CONDITIONS

TABLE II

The observed and calculated values of "Jassid Index"

Year	Observed	Calculated
1937	1.8219	1.4256
1938	1.1977	1.5226
1939	1.3086	1.5021
1940	1.7342	1.6720
1941	2.1088	1.9748
1942	1.8274	2.0611
1943	1.9837	1.9325
1944	2.2134	2.2753
1945	2.3741	2.2035

It will be seen from Table II and Figure 1 that the calculated and the observed indices are in close proximity.

SUMMARY

An attempt has been made to correlate the intensity of jassid attack during 1937-1945 with temperature, relative humidity and rainfall. Average mean temperature did not appear to influence the incidence of jassid attack to any appreciable extent. It has been shown that average relative humidity and total rainfall during the jassid period were the two main factors which determined the extent of jassid attack. High humidity and high rainfall acting together were conducive to higher jassid attack, while individually their effect was not significant. A partial regression equation has been worked out for calculating the mean jassid infestation for a particular year from the humidity and rainfall record of that year.

ACKNOWLEDGEMENT

The present study formed a part of the work on the Jassid Investigation Scheme financed by the Indian Central Cotton Committee.

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**A NEW ANOMALOUS ACALYPTRATE
FLY (DIPTERA).**

By GEORGE C. STEYSKAL, Grosse Ile, Michigan.

The fly herein described has been in the writer's hands for several years, during which time an exhaustive attempt was made to determine its relationships, without, however, much success, since it belongs to a group of families the delimitations of which are evermore becoming less distinct. It seems advisable to present at this time a description of the unique specimen and to append a discussion of its taxonomy.

***Cinderella lampra*, n.g. and n.sp.**

(Figure 1, wing; figure 2, head)

Female. Length of body, 1.8 mm.; length of wing, 1.65 mm.

Shining black, slightly brownish pruinose on mesonotal disc only; legs with middle and hind knees and tarsi yellow, the last tarsal joint brown, its claws black, the pulvilli white; antennae yellow, brown above on third joint, arista yellow on basal fourth; palpi black; proboscis piceous; wings hyaline or somewhat whitish, the veins pallid yellowish; calypters and their fringe white; halteres black, stem brown; all bristles and hairs black.

Head and antennae as figured, the third antennal joint covered with a fine pubescence, the arista bare; face carinate between the antennae and protuberant below, with shining white pruinose (tomentose) areas as figured. Eyes with 43 rows of similar ommatidia, counting from upper front to lower hind margin.

Thorax with one strong humeral, one sublateral close before the suture, two notopleural, two supra-alar, two dorsocentral, one prescutellar acrostichal, and two scutellars on each side, the scutellars convergent; approximately eight rows of hairs between the dorsocentral lines; scutellum bare above, convex; pleura lacking propleural, stigmatal, or mesopleural bristles or hairs; sternopleura with one posterior bristle and two anterior hairs; prosternum not examinable.

Wings as figured, the minute black costal spinules ending at two-thirds the distance from third to fourth longitudinal veins; calypters very small, with sparse, short fringe.

Legs with rather stout fore femora furnished with two or three posterodorsal bristles near middle and five or six posteroventral bristles on apical half; middle femur with one posterior preapical bristle; all tibiae with preapical dorsal bristle, that of middle tibia

1.5 times as long as diameter of tibia; middle tibia with one ventral, one posterior, and two anterior apical spurs; posterior basitarsus nearly twice as long as succeeding joint, scarcely greater in diameter; crown of spinules at tips of tarsal joints conspicuous; claws and pulvilli small; fore coxae with a row of three exterior bristles.

Abdomen ovate, flat above, furnished with sparse, bristly hairs; the intermediate segments subequal in length; the ovipositor retracted and bearing at its tip a pair of apparently soft cerci about as long as second hind tarsal joint; tergites without definite transverse wrinkle before posterior margin, turning well down on under side of abdomen; sternites small.

Holotype, female, Ada, Oklahoma, July 16, 1937 (Standish-Kaiser), no. 59162 in United States National Museum.

The genus, the characteristics of which may be gleaned from the foregoing description of its sole known species, belongs with the group of forms included in the families Sphaeroceratidae (= Borboridae, Cypselidae, etc.), Drosophilidae, Helomyzidae, Milichiidae, Piophilidae, and probably others. Its distinctly convergent postocellars, strong preapical tibial bristles, and the nature of the subcostal vein remove it from the Piophilidae, and one or another character precludes its ready placement in any one of the other groups.

In the Curran manual (1934: 24) *Cinderella* runs to the Drosophilidae, and in Brues and Melander (1932: 345) it runs to the subfamily Amiotinae of the Drosophilidae. In Hendel (1922, 1928, 1937) the genus runs to the Sphaeroceratidae, or if a defect in the key wherein but a single costal break is ascribed to the Drosophilidae be disregarded, to the Drosophilidae. The shining black body surface of *Cinderella* is not Drosophiline and the outstanding character of that group, the presence of a proclinate fronto-orbital bristle, is lacking.

The Sphaeroceratidae are generally characterized as having the hind basitarsus shorter and considerably greater in diameter than the succeeding joint. Aside from this character, *Cinderella* might well go in the Sphaeroceratidae, in the group that has been called *Bordoridae spuriae* by Duda (1921) and later given subfamily rank as Cypselosominae by Hendel (1931). The group, except for the dubious genus *Therina* Meigen,¹ lacks the second basal cell and the

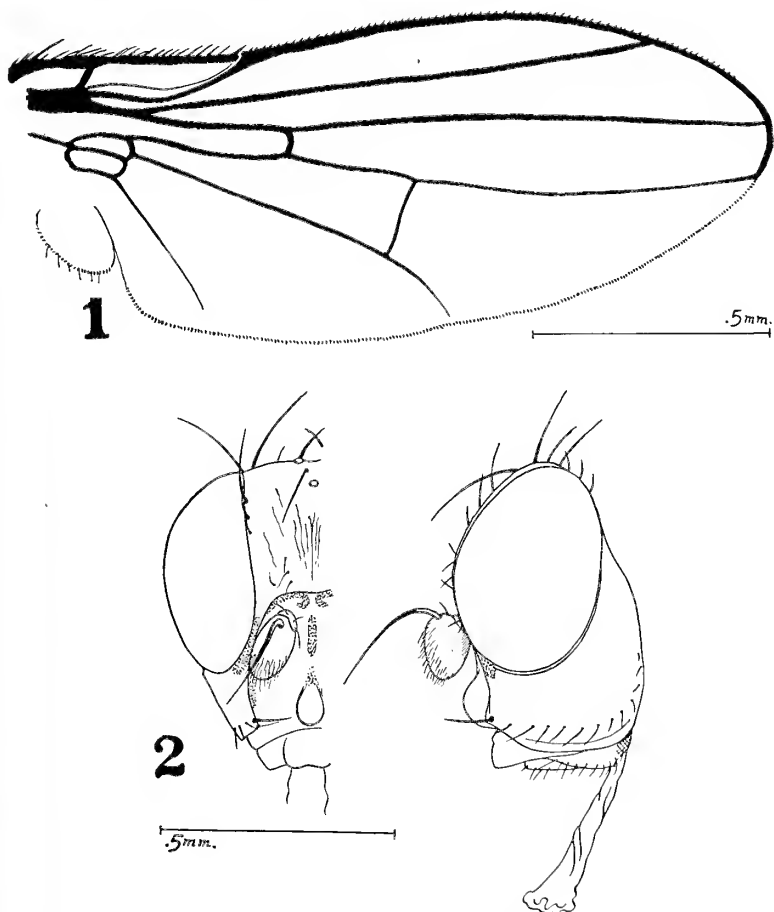
¹ *Therina femoralis* Meigen, Syst. Besch. 6: 197, pl. 62, ff. 7-9 (1830), was described without locality citation, and has never been recognized. The type is lost and the name is antedated by *Therina* Huebner 1826.

anal cell is rudimentary. *Therina* disagrees with the present form in a number of points. Duda himself (1938) and Richards (1930, 1931) have rejected the "*spuriae*" from the Sphaeroceratidae.

Cinderella seems to have a relationship with the austral genera *Notomyza* Malloch (1933a, Patagonia) and *Protoborborus* Malloch (1933b, New Zealand). Its author referred the latter genus to the Sphaeroceratidae, although the hind basitarsus is long and slender, and remarked upon its similarity to *Notomyza*, which genus, however, he placed in the Helomyzidae, defining that family on a broader basis than is usual. Our genus is most similar to *Notomyza*, differing in having two rather than three dorsocentral bristles, the fronto-orbital bristles reclinate rather than curving outward over the eyes, and a nasute face.

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EXPLANATION OF PLATE XII

FIG. 1 - *Cinderella lampra* n.gen. and sp., wing.

FIG. 2 - *Cinderella lampra* n.gen. and sp., head.

THE IDENTITY OF TWO NEARCTIC SIMULIIDAE (DIPTERA)

By ALAN STONE, Washington, D. C.

In the course of taxonomic studies on the Nearctic Simuliidae, the types of two of the older species have been examined and have been found to agree with species currently going under subsequent names. In order that these species may be associated with their prior names, the following notes are offered.

Simulium (*Neosimulium*) *argus* Williston.

Simulium argus Williston, 1893. North American Fauna 7: 253.

Eusimulium obtusum Dyar and Shannon, 1927. Proc. U. S. Natl. Mus. 69(10): 15. (New synonymy).

Simulium kamloopsi Hearle, 1932. Proc. Ent. Soc. Brit. Columbia. 29: 12. (New synonymy).

Simulium hearlei Twinn, 1938. Canad. Ent. 70: 50.

Coquillett (1900, p. 394) considered *Simulium argus* Williston to be a synonym of *S. vittatum* Zetterstedt. Since these two known species of the subgenus *Neosimulium* in the Nearctic region are scarcely distinguishable in the female except by an examination of the genital fork, this opinion is quite understandable. Through the kindness of Dr. R. H. Beamer I was loaned the type female of *argus* from the Entomological Museum, University of Kansas, with permission to prepare a dissection of the genitalia. When this was done, it was clear that *argus* closely agreed with the species that Hearle described as *kamloopsi* and not with *vittatum*. Since *argus* and *vittatum* occur together in many parts of California as well as elsewhere, specimens from the type locality of *argus* may prove to be *vittatum*, but the single type female is definitely not *vittatum*.

The type series of *Eusimulium obtusum* Dyar and Shannon consists of two males collected at Redlands, California, 1914, by F. R. Cole, each mounted whole on a slide. One of these, which I here designate as lectotype, shows the genitalia clearly and it agrees with the male of *kamloopsi*. The second is evidently *Simulium* (*Eusimulium*) *aureum* Fries, although the mount is not very satisfactory. It seems better to sink *obtusum* under the more certain of the two species involved, even though the subgeneric relationship is more remote.

Simulium kamloopsi Hearle was described from a holotype male, allotype female, and many paratypes with associated pupae collected

at Kamloops, B. C. I have examined the types in the Canadian National Collection and find that the species is readily separable from *vittatum* by the female genital fork, male genitalia, and the pupa.

Simulium hearlei Twinn was described from males collected at Fort Duchesne, Utah. This species was synonymized with *kamloopsi* by Stains and Knowlton (1943, p. 274), and since this synonymy appears to be quite correct it now falls under *argus*.

Simulium (Simulium) jenningsi Malloch

Simulium jenningsi Malloch, 1914. Bur. Ent. Tech. Ser. Bul. 26: 41.

Simulium nigroparvum Twinn, 1936. Canad. Jour. Res. 14(D): 142. (New synonymy).

The type of *Simulium jenningsi* is a female collected on Plummers Island, Maryland, July 8, 1904; the allotype, a male collected at the same place June 28, 1902. Dyar and Shannon (1927, p. 45) treated this as a synonym of *venustum* Say, but a closer examination of the material on which Malloch based the species shows it to be different from *venustum* and to agree with the species that Twinn described as *nigroparvum*. It is unfortunate that Malloch selected a female as the holotype, since this sex is more difficult to separate from *venustum* than the male or pupa. The type does show, however, black hairs on the stem vein, no hairs beneath on the subcosta, a dark pleural tuft, no recumbent pale hairs on the scutellum, and the genital fork with the distal lobes rounded. In all these respects it agrees with *nigroparvum* and disagrees with *venustum*.

The allotype male shows genitalia agreeing exactly with those of *nigroparvum*, and the pupae that Malloch mentions from Frierions Mill, Louisiana, also agree with that of *nigroparvum*. It is quite evident that most of the specimens that Malloch had when he described *jenningsi* were not *venustum*, and there is no reason to doubt that the type is the same as *nigroparvum*. For an excellent treatment of this species one should consult Underhill (1944).

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BOOK NOTES

A Century of Entomology in the Pacific Northwest. By Melville H. Hatch. v + 43 pp., 9 photographs. 6×9 ins., cloth bound. 1949. University of Washington Press, Seattle, Washington. (Price, \$1.50)

This book traces the principal events, names the outstanding men and cites the more important publications involved in the development of entomology in the Pacific Northwest. It concludes with a survey of the present status of entomology in the area. The book is extremely well written and should be very useful to those who are interested in any phase of entomology of the Northwest or in any of the persons associated with entomology in that area. GEORGE S. TULLOCH, Merrick, New York.

The Natural History of Mosquitoes. By Marston Bates. xv + 379 pp., 9 figures, 14 tables, 16 pages of photographs. 1949. The Macmillan Company, New York, N. Y. (Price, \$5.00)

Dr. Bates has brought together an amazing amount of factual material and presented it in such a way that it is of interest both for the layman as well as the professional entomologist. The first portion of the book is concerned with the behavior, physiology and environmental relations of all stages of the mosquito. The second portion deals with mosquitoes in relation to other organisms which is of particular interest to the medical entomologist. The remaining chapters are devoted to the species problem, the classification and distribution of mosquitoes, techniques in mosquito study and the strategy of mosquito research. There is an appendix containing a systematic list of mosquito species (7 pages), a bibliography of over 600 titles (46 pages) and an index (11 pages). GEORGE S. TULLOCH, Merrick, New York.

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A NEW GENUS IN THE SUBFAMILY BLISSINAE FROM MEXICO AND A NEW NYSIUS FROM THE NORTH WEST. (LYGAEIDAE; HEMIPTERA- HETEROPTERA)

By H. G. BARBER, Roselle, N. J.

Praeblissus n. gen.

Head and pronotum anteriorly, not pruinose, shining. Head much wider than long. Eyes much as in *Blissus*. Ocelli set closer together than in *B. leucopterus*. Antennae longer than head and pronotum combined, second and third segments equal, third distinctly clavate. Pronotum nearly twice as wide as long; anterior margin strongly concavely arcuate; posterior margin truncate before base of scutellum; humeral angles bluntly rounded. Scutellum much wider than long. Corium dull, opaque, not viterous as in *Blissus*. Clavus more widely expanded posteriorly than in *Blissus*; commissure distinctly longer than the scutellum; apical margin of corium straight, not obtusely angulated at apex of clavus as in *Blissus*. Membrane opaque; veins indistinct. Connexivum rather widely exposed, outer margin of each segment gently rounded, pilose. Intermediate and posterior coxae widely separated. Rostrum reaching to base of venter. Venter densely pilose. Pterygodimorphic.

Genotype: *Praeblissus albopictus* n. sp.

Praeblissus albopictus n. sp.

Head, anterior half of the pronotum, shining black, pilose; posterior half of pronotum dull, velvety black. Scutellum dull black. Corium fusco-piceous, with a prebasal, transverse, irregular white fascia which extends slightly on to the middle point of the clavus, the apex of which is narrowly white. Membrane fusco-piceous.

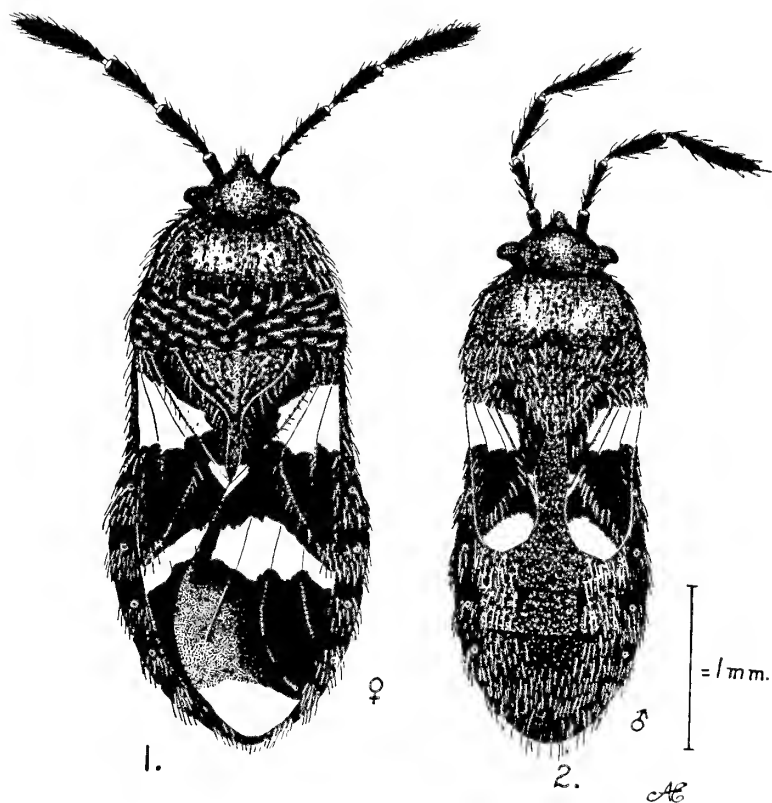
dull, opaque, with an irregular transverse basal white fascia, somewhat expanded toward the inner angle; apex narrowly, transversely, white. Connexivum black, anterior half of each segment dull, posterior half densely covered with silvery white hairs. Beneath piceous. Legs shining, fusco-piceous, trochanters, apices of femora and tibia as well as the tarsi, pale yellow testaceous. Rostrum fusco-testaceous. Antennae fusco-piceous, with incisures narrowly white.

Head one third wider than long (30×20), finely sparsely punctate, sparsely pilose. Eyes prominent. Ocelli three times as far apart as each is removed from an eye. Antennae with terminal segment one and a half times longer than the third. Pronotum sparsely long pilose, coarsely punctate on the anterior half, posterior half finely, sparsely punctate, not quite twice as wide as long (55×30). Scutellum dull, much wider than long (28×16), rather coarsely punctate on either side, longitudinally smooth through the center. Corium dull, opaque, not vitreous; apical margin straight, not obtusely angulated at apex of clavus, as in *Blissus*; clavus widely expanded posteriorly, commissure distinctly longer than the scutellum. Membrane in the macropterous form attaining apex of abdomen, its length through the middle slightly longer than the costal margin of corium. Connexivum rather widely exposed, pilose, each segment depressed in the center, outer margin of each segment gently rounded. Length 3.50 mm.

Type macropterous female; (U.S. Natl. Mus. type, number 59311) Pueblo, Mexico, intercepted by T. P. Chapman, Inspector for Division of Foreign Plant Quarantine, Bureau of Entomology and Plant Quarantine, at Laredo, Texas on orchids (*Chrysis*), July 29, 1948. 6 paratypes with the same data as the type: 1 female (macropterous), 1 female (brachypterous), 4 males (brachypterous). In addition there are 12 nymphs representing three instars. (All in the collection of the U.S. Natl. Mus.)

In the brachypterous male the commissural margins behind the scutellum are widely separated and the inner margins of the membrane almost in contact, the apical margin of which is evenly rounded and extended to about the middle of the tergum.

Praeblissus is closely related to *Blissus* from which it differs most markedly in the coleopteroid like character of the surface of the pronotum, opaque hemelytra and membrane, longer claval commissure and straight posterior margin of the corium.



EXPLANATION OF PLATE XIII

1. Dorsal view of female (macropterous).

2. " " " male (brachypterous).

Illustrations by Miss Addie Egbert, Division of Insect Identification, Bureau of Entomology and Plant Quarantine.

Nysius paludicola n. sp.

General color griseus. Intra-orbital fascia, pronotal cicatrices, scutellum except extreme apex, ventral surfaces for the most part, genital segment of the male, a few inconspicuous spots on the veins of corium and three on the posterior margin, fuscous. Membrane hyaline, faintly spotted through the center. Antennae with the basal and terminal segments fuscous, second and third ferruginous. Femora heavily mottled with fuscous.

Head one fifth wider than long (50×40); eyes large, protruding. Bucculae a little higher in front, gradually narrowing posteriorly, ending abruptly just before base of head. Antennae three times as long as head, second segment over twice as long as basal, lengths of segments are 18:40:30:32. Pronotum subequally as long as the head and a little wider (50×60), and one third wider than long (60×40), dorsum rather flat, lateral margins very gradually converging anteriorly, nearly straight, lightly constricted midway; cicatrices meeting in the center, disk coarsely punctate behind the cicatrices. Scutellum nearly one fourth wider than long (38×30), coarsely punctate at base and on either side of the median carina. Surface of the corium very sparsely if at all pilose, costal margin just over two and one half times as long as the pronotum, contracted basal part equal to the length of scutellum, rather more flaring, posteriorly in the female. Membrane extending a little beyond the apex of the abdomen. Length 5.30 mm.

Type male, Shaw Is., San Juan Co., Wash., in salt marsh; July 28, 1926 (Worley). Paratypes; 4 males and 2 females with the same data as the type; 1 male, San Juan Is., Carter Point near Friday Harbor, Wash., July 23, 1944 (R. I. Shenfelt), swept from *Salicornia* sp?; one male Jasper, Alberta, Canada, Aug. 8 (C. T. Parson); all in the authors collection. The San Juan Is. specimens were sent to the author for identification by Professor M. T. James, State College, Pullman, Wash. and two paratypes were returned for the collection.

N. paludicola is closely related to *angustatus* Uhler. Besides its much larger size it is distinguished by the longer antennae, longer bucculae which do not quite reach to base of head, contracted basal part of the costal margin equalling the length of the unicolorous scutellum.

From the foregoing data it is apparent that this species lives in salt marshes, feeding on the common salt marsh plant, *Salicornia*.

STUDIES ON THE COTTON JASSID (*EMPOASCA DEVASTANS* DIST.) IN THE PUNJAB: IX. A CONSIDERATION OF THE LIGHT TRAP COLLECTIONS.

By M. A. GHANI and MOHAMMAD AFZAL
Cotton Research Laboratory, Lyallpur, Pakistan.

INTRODUCTION

A very large number of species of insects are known to be positively phototropic. The economic entomologists have taken advantage of this peculiarity of these insects and have recommended light traps as a measure of control against some very serious crop pests. It is very unfortunate that no serious attempt seems to have been made in the subcontinent of India to study the phototropic response of the family Jassidae, particularly that of cotton jassid (*Empoasca devastans* Dist.), which is one of the major pests of cotton. The fact that no effective method of control of this pest is known at present, makes this study even more essential. To study this aspect of the behaviour of this important group of insects, and to explore the possibilities of its being used as a means of control, a preliminary attempt was made to collect jassids by means of a light trap.

MATERIAL AND METHOD

A strong light trap with 100 candle power filament electric lamp emitting white light, at a height of 4 feet from ground level, was put up once a week, in an open place near the cotton fields (5 feet from the nearest field) at Lyallpur, from the middle of June, 1943 to the middle of June, 1944. The light trap was operated from dusk to dawn. All the insects collected were killed next morning by fumigation with carbon bisulphide. The jassids were then sorted out from the rest of the insects and counted. The total number of jassids collected, the percentage of *E. devastans* in the collection, and the percentage of females in the latter group, were worked out. These data are given in Table I.

It may be mentioned here that in this study a 100 candle power lamp was used only as a source of "strong" white light. It might perhaps have been more desirable to first carry out experiments with lights of varying intensities and different wave-lengths to find out the most effective light. It was, however, decided that for the preliminary study a 100 candle power white light would serve the purpose.

TABLE I

Date	Total Jassids	% of E. devastans	% females devastans	Min. Temp.	Av. Rel. Humidity
15. 6.43	1048	5.3	85.5	71.3	53.5
22. 6.43	565	11.3	79.0	81.1	50.1
29. 6.43	663	15.2	78.4	88.0	53.9
6. 7.43	718	7.1	78.4	84.1	52.9
13. 7.43	1545	1.9	96.7	73.4	66.1
20. 7.43	1185	3.5	73.0	79.9	76.0
27. 7.43	628	4.6	72.4	79.1	80.1
3. 8.43	3007	4.5	88.9	83.0	77.5
10. 8.43	764	10.3	85.7	81.9	82.6
17. 8.43	6149	52.1	82.7	83.1	66.9
24. 8.43	691	36.9	66.4	82.1	65.9
31. 8.43	1897	21.1	71.3	79.3	66.7
16. 9.43 ¹	270	17.4	67.6	84.1	66.3
22. 9.43	1112	17.4	67.6	81.9	67.3
29. 9.43	49	22.5	45.5	66.1	56.3
6.10.43	14	7.1	...	65.1	54.6
13.10.43	3	...	...	61.1	58.0
20.10.43	1	...	...	58.7	56.0
27.10.43	8	...	...	54.4	59.7
4.11.43	0	...	...	57.1	66.6
10.11.43	1	...	...	52.8	72.7
17.11.43	4	...	...	49.1	69.9
7. 4.44 ²	20	...	...	58.1	81.1
21. 4.44	524	0.4	...	72.9	48.6
25. 4.44	146	0.7	...	75.1	51.3
3. 5.44	474	0.2	...	70.1	38.4
10. 5.44	28	...	...	73.1	38.1
17. 5.44	1084	0.6	71.4	72.4	51.6
25. 5.44	334	1.2	75.0	76.1	35.6
2. 6.44	179	5.0	55.6	75.1	31.8
7. 6.44	153	5.9	77.8	77.1	47.4
14. 6.44	353	3.4	75.0	76.3	53.4

¹ Light trap was not set up on 7.9.43.² No jassids were collected in the trap between 24.11.43 and 29.3.44. Minimum temperature varied between 38.1 and 55.1. Average relative humidity between 72 and 96.3.

DISCUSSION OF DATA

(1) *Period of jassid activity.*

The figures in Table I are in conformity with the previous experience (Afzal and Ghani, 1945) at Lyallpur that jassid attack starts early in June, is at its highest in August, and then declines rapidly. There are very few jassids on the cotton plants by the end of September. During the rest of the period very few specimens or none at all were attracted to the light trap. It is, however, known that jassids overwinter in the adult stage, but the number of insects which survive the cold weather must be very small and these also remain very inactive and concealed in places of shelter. Low population and inactivity of the insects are the two probable causes of small or no catches during the cold weather.

(2) *Proportion of E. devastans in different catches.*

E. devastans formed a fair proportion of the total catch throughout the year. The period of activity of this pest, as shown by the catches, coincides with that of the rest of the members of this family. It was attracted to light from the third week of April up to the first week of October, and during the rest of the period not a single specimen could be collected. It formed the highest percentage, 17.4 to 52.1, from the middle of August to the end of September. Thus, although no attempt was made to determine the proportion of the daily catches to the total population of the insect, the numbers caught on the light trap lead one to conclude that, during the season when this pest is most active on the cotton plant, the light trap offers a fairly effective means of attracting it away. The utility of light trap would, of course, be increased manifold if it were placed inside the cotton fields.

(3) *Proportion of sexes in E. devastans collections.*

It is very interesting to note that the number of females of *E. devastans* attracted to light trap in various catches was preponderately high throughout the year. The proportion of the two sexes in the field is almost 50:50, but the fact that by far the largest number of females was attracted to the light trap, makes this method a fairly useful and effective measure of control. This is quite contrary to the experience of Wheeler (1937) in the United States, who records that the males of *Empoasca* spp. (*E. fabae* Harr., *E. crigeron* De Long, *E. pergandi* Gill, and *E. solana* De Long) far outnumbered the females in her light collections, though in the fields the proportion of sexes was quite the reverse. This difference may be due either to different species or different environmental conditions, or both.

(4) *Wave length of the light trap.*

The phototropic response of *E. devastans* has not, so far as we are aware, been studied in detail before, and the present work has opened up a line of research which may be followed up. We have, for example, studied the reaction of the insect to white light only, but it is quite possible, as has been found in the case of Aleurodidæ, by Deshpande (1936) in India, and other insects by Burks and Ross (1938), Marshall and Henton (1938) in the United States, that lights of different wave lengths may have markedly different attractive capacities.

(5) *Influence of weather condition on the size of the catch.*

The number of jassids collected on different nights at the light trap is very fluctuating. The reason for these variations appears to lie in the weather conditions prevailing during the period of study. Williams (1936) noticed that larger catches of nocturnal insects were obtained in Britain during dark and cloudy nights, the cloudy nights being associated with warmer conditions. Caruth and Kerr (1937) have observed in the United States that the light trap collections were appreciably influenced by night temperatures, and that the collection fell considerably when the minimum temperature sank below 60° F. Afzal Husain *et al* (1934) studied the phototropic response of *Platyedra gossypiella* Saund. in the Punjab and came to the conclusion that it depended largely on temperature. They also found that moonlight affected the phototropic activity adversely. Sorensen (1939) found that *Lygus hesperus* Knight and *Lygus elisus* Van Duzee were attracted to light only on warm cloudy nights. Leach and Mullin (1942) have recorded that distinct peaks of activity of aster leafhoppers, as judged by the light trap collections, occurred during periods of successive warm nights.

In order to elucidate the effect of weather conditions on the number of jassids caught, the minimum temperature and the average relative humidity are shown against weekly catches in Table I. Very few figures of rainfall were available, and as the relative humidity is conditioned by the rainfall, the latter factor only was taken into consideration. It may be mentioned that in the absence of self-recording meteorological instruments no continuous records of temperature or humidity were available. The figures given in Table I are the routine figures available from the Pakistan Meteorological Department. The minimum temperature is the lowest temperature reached at any time during the night. The figures of humidity indicate the average relative humidity of the previous week.

To assess the effect of temperature and humidity on the size of the catch, the figures of weekly catches in Table I were smoothed out by taking $\log (n + 1)$ and their correlations worked out.

(a) *Effect of temperature and humidity on catches.* It will be seen from Table I that very few insects were attracted to light when the minimum temperature fell below 70° F., and none at all when it sank below 52° F. The largest catches were obtained when it ranged from 72° to 88° F. The simple correlation between catches and minimum temperature was worked out as follows:

Light trap catches and minimum temperature

$$r = +0.9328 \text{ Highly significant}$$

The correlation was significant up to one percent level and was a positive one, showing thereby that the number of insects collected was greatly influenced by the temperature, and it increased with the increase in minimum temperature.

The simple correlation between catches and relative humidity was as follows:

Light trap catches and relative humidity

$$r = -0.5482 \text{ Highly significant}$$

The correlation in this case also was significant up to one percent level, but was a negative one, showing thereby that the number of insects attracted was also influenced by the relative humidity; it increased as the humidity fell, and vice versa.

It will be seen from the foregoing that both these correlations were highly significant, but an integrated effect of both these factors on the catches can only be found out by working out the partial correlations, as it is only then that the actual effect of each factor can be accurately assessed. The partial correlations were worked out and are given below:

Partial correlation coefficient between catches and relative humidity keeping minimum temperature as constant

$$= 0.1122 \text{ Non-significant}$$

Partial correlation coefficient between catches and minimum temperature keeping relative humidity as constant

$$= 0.9037 \text{ Highly significant}$$

It will be noticed from above that the partial correlation coefficient between catches and humidity was non-significant, while it was significant at one percent level between catches and minimum temperature. This shows that humidity played very little part, and size of the catches on different nights was mainly influenced by minimum temperature. This finding is very interesting, as the

total number of jassids, as well as of other insects, falls down considerably during the winter months. Thus when temperature goes down, the number of insects, as well as their activity, also declines.

(b) *Effect of moonlight on catches.* It is very difficult to separate the effect of moonlight from various other factors which influenced the size of the catch, as by the time the opposite phase of the moon appeared the weather conditions were changed to a considerable extent. Moreover, the observations were taken at weekly intervals. During this period both the phase of the moon and weather conditions changed and thus it became difficult to assess the effect of the two separately.

SUMMARY

The phototropic response of family Jassidae, with special reference to cotton jassid, was studied for a complete year at Lyallpur. A light trap with 100 candle power lamp was put up once a week from dusk to dawn. The total number of jassids, the proportion of *E. devastans*, and the proportion of females in the *E. devastans* collections, were worked out from the weekly collections.

It was seen that jassids were attracted to light from the end of April to the end of September. The percentage of *E. devastans* was highest in catches from the middle of August to the middle of September. The percentage of females in the *E. devastans* collections was preponderately high throughout the course of the year.

An attempt was made to study the influence of weather conditions on the catches. It was seen that largest number of jassids were collected when the minimum temperature ranged from 72° to 88° F. This showed that jassids preferred warm nights for their nocturnal activities.

The correlation coefficient between catches and minimum temperature was positive and highly significant (+0.9328), while it was negative and highly significant between catches and relative humidity (-0.5482). The partial correlation coefficient was significant in the case of catches and minimum temperature (0.9037), while it was non-significant in the case of catches and relative humidity. This showed that the size of the catch on different nights was mainly dependent upon minimum temperature and that the humidity had very little influence over it. It was, however, not possible to separate the effect of moonlight on the size of the catch, from the various other factors that influenced it.

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**NEW OR INSUFFICIENTLY-KNOWN CRANE-FLIES
FROM THE NEARCTIC REGION (DIPTERA,
TIPULIDAE). PART XI.¹**

By C. P. ALEXANDER, Amherst, Mass.

The preceding part of this series of papers was published in 1949 (*Bull. Brooklyn Ent. Soc.*, 44: 98-104). The crane-flies discussed herewith are from Oregon where most of the species were taken by Mr. Kenneth M. Fender, who has added vastly to our knowledge of the insect fauna of the state. Acknowledgements to collectors of other material are made in connection with the various species concerned. The types of the novelties are preserved in my personal collection through the appreciated kindness of the collectors. A detailed report on the crane-flies of Oregon has been completed and should appear in press in due course. This list now embraces some 315 species of Tipuloidea and is one of the four largest state lists as known to this date.

***Tipula* (*Lunatipula*) *siskiyouensis* n. sp.**

General coloration gray, the praescutum with four brown stripes the intermediate pair widely separated; antennae with scape and pedicel light yellow, flagellum brownish black; vertex with a central brown line; femora weakly darkened, the tips brown; wings with a weak brownish gray tinge, very vaguely patterned with brown; obliterative band before cord relatively conspicuous; abdomen yellow, both tergites and sternites conspicuously trivittate with brown, the median stripe broader and virtually continuous; male hypopygium with the caudal border of tergite produced into four lobes, the lateral pair long and slender, the intermediate ones shorter; inner dististyle complex, the beak very slender, the outer basal lobe a long flattened blade that is dilated on the basal half, thence narrowed into a long slender apical portion; eighth sternite bearing two flattened lobes that are provided with a brush of unusually long yellow setae, these roughened by small lateral hairlike projections.

Male.—Length about 15 mm.; wing 14.5 mm.; antenna about 4.5 mm.

Frontal prolongation of head infuscated, weakly pruinose above, more obscure yellow on sides, relatively long, subequal in length to

¹ Contribution from the Department of Entomology, University of Massachusetts.

the remainder of head; nasus elongate; palpi dark brown. Antennae (male) of moderate length, as shown by the measurements; scape and pedicel light yellow, flagellum brownish black; flagellar segments only moderately incised, subequal in length to the longest verticils. Head light gray, the vertex with a brown central line.

Pronotum gray, variegated with brown. Mesonotal praescutum gray, with four brown stripes, the intermediate pair separated by a ground vitta that is about two-thirds as wide; lateral stripes slightly broader than the intermediates; posterior sclerites of notum gray, each scutal lobe with two confluent brown marks; a brown depression at base of scutellum on either side; mediotergite with a blackish area on either side on cephalic half. Pleura and pleurotergite clear gray; dorsopleural region more buffy. Halteres broken. Legs with the coxae light gray; trochanters yellow; femora obscure yellow basally, more infuscated beyond, the tips brown; tibiae brown, the tips more narrowly darkened; tarsi dark brown; claws (male) toothed. Wings with a weak brownish gray tinge, very vaguely patterned, including the medium brown stigma and very small clouds over the origin of R_s and the anterior cord; obliterative band before cord relatively conspicuous, extending into base of cell M_3 ; no distinct post-stigmal brightening; space above stigma more yellowed; veins brown. Venation: R_s about three times R_{2+3} ; R_{1+2} entire; petiole of cell M_1 shorter than m ; M_{3+4} subequal to or shorter than basal section of M_{1+2} .

Abdomen yellow, both the tergites and sternites conspicuously trivittate with brown, the median stripe broader and virtually continuous; hypopygium relatively large, brownish yellow to weakly infuscated. Male hypopygium with the ninth tergite large, transverse; caudal border with four lobes, the sublateral or outer pair appearing as a long slender rod, the tip obtuse, blackened; intermediate lobes much shorter, blackened, their tips obtuse; margin between the lobes produced into a low pale triangular blade on either side of the midline. Outer dististyle an unusually small pale blade, flattened and moderately elongate, the upper edge with three black setae, the remainder of surface glabrous. Inner dististyle of peculiar conformation; what seems to represent the normal beak is slender, straight, subtended above by a pale membranous dorsal crest; posterior portion of main body of style produced into a flattened blade that is unequally bispinous, the upper arm a strong erect spine, the lower one a small triangular point; outer basal lobe very conspicuous, appearing as a flattened blade that is longer than the remainder of style, dilated on basal half and here provided with

numerous long pale setae, thence narrowed into a more slender apical portion, the whole bent forwards over the main body of style. Gonapophyses paired, each half terminating in a long decurved point. Eighth sternite bearing a flattened lobe or blade on either side of midline, each bearing a brush or tuft of very long yellow setae that are very conspicuously roughened by lateral hairlike projections to produce an unusually fuzzy appearance.

Habitat: Oregon (Josephine County).

Holotype: ♂, O'Brien, Siskiyou National Forest, altitude 1475 feet, along roadside, March 24, 1940 (R. L. Post, Zelna Maris and Marshall Ross).

This distinct fly seems to be most nearly allied to species such as *Tipula* (*Lunatipula*) *diabolica* Alexander and *T. (L.) perfidiosa* Alexander, differing most evidently in the very peculiar structure of the male hypopygium. I am indebted to Professor Post for this and other rare and interesting Tipulidae from Oregon.

***Limonia (Dicranomyia) inhabilis* n. sp.**

Mesonotum chiefly brownish yellow, very sparsely pruinose; antennae brown throughout; halteres short; legs pale brown, the outer tarsal segments more darkened; wings subhyaline, stigma faintly indicated; male hypopygium with the tergite transverse, the caudal margin broadly emarginate, the lateral lobes low; basistyle without accessory lobules; ventral dististyle about twice as extensive as the basistyle; rostral spines long and slender, slightly exceeding the prolongation; aedeagus deeply bilobed.

Male.—Length about 6.5 mm.; wing 7 mm.

Rostrum and palpi brown. Antennae brown throughout; flagellar segments short-oval to subcylindrical. Head brown above.

Pronotum brown. Mesonotum chiefly brownish yellow, with a very sparse pruinosity, the anterior part of the praescutum a trifle darker. Pleura and pleurotergite more yellowed. Halteres short, infuscated, the base of stem yellow. Legs with all coxae and trochanters light yellow; remainder of legs pale brown, the outer tarsal segments more infuscated. Wings subhyaline, the stigma very weakly more darkened; veins pale brown. Venation: *Sc* short, *Sc*₁ ending a distance before origin of *Rs* about equal to *r-m*, *Sc*₁ alone nearly three times *Sc*₂; cell 1st *M*₂ large, nearly as long as the distal section of vein *M*₁₊₂; *m-cu* at or close to the fork of *M*.

Abdomen, including hypopygium, pale brown. Male hypopygium with the tergite transverse, the caudal margin broadly emarginate, the lateral lobes low; margin with three separate groups

of setae, those of the median group smaller. Basistyle with ventromesal lobe simple; no distinct accessory lobule as in *acerba*, *citrina* and *fulva*. Dorsal dististyle a slightly arcuated slender pale rod, the tip narrowed and bent at a right angle into a straight black spine. Ventral dististyle fleshy, its total area somewhat less than twice that of the basistyle; rostral prolongation darkened, relatively stout, the outer margin gently convex to the blunt tip; rostral spines arising from two very closely approximated basal tubercles, placed at the extreme base of the prolongation; spines black, long and slender, slightly exceeding the prolongation in length. Gonapophysis with mesal-apical lobe blackened, gently curved to the acute tip, the concave margin with one or two weak denticles. Aedeagus at apex deeply bilobed by a median notch.

Habitat: Oregon.

Holotype: ♂, Three Rivers, Grand Ronde-Tillamook Highway, Coast Range, May 23, 1948 (K. M. Fender).

While generally similar to *Limonia* (*Dicranomyia*) *fulva* (Doane) and some allied species, the present fly is distinct in the hypopygial characters, as described.

***Limonia* (*Dicranomyia*) *willamettensis* n. sp.**

Generally similar to *vulgata*; mesonotum yellow, the praescutum with three black stripes; antennae with scape yellow, the remainder black; wings whitish subhyaline, the stigma conspicuous; cell M_2 open by the atrophy of m ; male hypopygium with the ninth tergite broadly emarginate, the obtuse lobes with broadly thickened margins; ventral dististyle slightly smaller than the basistyle; rostral prolongation long, with two long spines that are subequal to the prolongation; mesal-apical lobe of gonapophysis a slender curved blackened spine; aedeagus unusually long and slender, directed ventrad, blackened.

Male—Length about 5.5–5.8 mm.; wing 6–6.5 mm.

Rostrum light yellow; palpi darker. Antennae with the scape yellow, remainder of organ black; flagellar segments oval, with long verticils, the segments well-separated. Head dark gray; anterior vertex broad.

Pronotum dull black medially, yellowed on the sides. Mesonotum obscure yellow, the praescutum with three black stripes, the interspaces distinct; scutal lobes similarly blackened; scutellum brownish black, parascutella yellow; mediotergite obscure yellow, darker behind. Pleura and pleurotergite yellow, the ventral sternopleurite weakly darkened. Halteres with stem yellow, knob infus-

cated. Legs with the coxae and trochanters yellow; remainder of legs obscure yellow, the outer tarsal segments blackened; claws long, with a single slender basal spine. Wings whitish subhyaline, the prearcular and costal fields a trifle more yellowed; stigma oval, rather dark brown, conspicuous; veins brown, paler in the brightened fields. Venation: Sc_1 ending opposite the origin of R_s , Sc_2 some distance from its tip so Sc_1 alone is approximately one-half as long as R_s ; cell M_2 open by the atrophy of m ; $m-cu$ longer than the distal section of Cu_1 , close to the fork of M .

Abdominal tergites dark brown; sternites and subterminal segment yellow; hypopygium chiefly darkened. Male hypopygium with the ninth tergite broadly emarginate, the obtuse lobes with broadly thickened margins, the setae restricted to this portion. Basistyle with the ventromesal lobe oval. Dorsal dististyle a long slender curved rod that narrows very gradually into a long slender spine. Ventral dististyle slightly smaller than the basistyle; rostral prolongation long, with two long spines, these subequal in length to the prolongation, without basal tubercles; the more basal spine placed low down on face of prolongation, the outer one closer to the upper margin. Gonapophysis with mesal-apical lobe a slender curved blackened spine. Aedeagus unusually long and slender, blackened, directed ventrad and very conspicuous; tip narrowed, not bifid.

Habitat: Oregon (Yamhill County).

Holotype: ♂, Willamette River, 2 miles south of Dayton, June 24, 1948 (K. M. Fender). *Paratopotype*, 1 ♂.

Generally similar to *Limonia* (*Dicranomyia*) *vulgata* (Bergroth), differing in the details of coloration and structure of the male hypopygium, particularly the ninth tergite, ventral dististyle, gonapophysis and aedeagus.

***Limnophila* (*Phylidorea*) *pacalis* n. sp.**

Mesonotum obscure brownish yellow, the praescutum with a poorly defined brown central stripe; antenna beyond the scape obscure brownish yellow; femora yellow, all with a pale brown subterminal ring that is wider than the pale apex; wings yellow, unpatterned except for a black spot at outer end of the otherwise deep yellow stigma; male hypopygium with the tergal lobes conspicuous, separated by a U-shaped notch; gonapophysis terminating in a simple spearlike point.

Male.—Length about 9 mm.; wing 9.5 mm.

Female.—Length about 11–12 mm.; wing 10.5–11 mm.

Rostrum black, sparsely pruinose; palpi black. Antennae with scape black; remainder of organ obscure yellow, the outer flagellar segments more obscured; basal flagellar segments oval, the outer ones subcylindrical; verticils long and conspicuous. Head dark gray.

Pronotum infuscated medially, obscure yellow on sides. Mesonotal praescutum obscure brownish yellow, with a poorly defined brown central stripe, best-indicated in front, the lateral stripes sometimes faintly indicated; posterior sclerites of notum chiefly brownish yellow, the mediotergite somewhat more grayish on central portion. Pleura brownish yellow. Halteres with stem pale, knob weakly infuscated. Legs with all coxae and trochanters yellow; femora yellow, all legs with a pale brown subterminal ring, the pale apex much narrower; in the more heavily patterned specimens the darkened rings are virtually terminal in position; tibiae yellow, the tips very narrowly darkened; tarsi obscure yellow, the outer segments brownish black. Wings yellow, cells *C* and *Sc* even more saturated; no pattern except for a tiny dark spot at outer end of the otherwise deep yellow stigma; veins brown, those in the costal field yellowed. Venation: Petiole of cell *M*₁ subequal to or shorter than the cell.

Abdomen reddish yellow, the subterminal segments black; genital shield of female, as well as the male hypopygium, yellowed. Male hypopygium with the lobes of the tergite conspicuous, separated by a U-shaped median notch, the surface with numerous pale setae. Setae of the basistyle unusually long and numerous, pale. Inner dististyle with the apical narrowed portion a little shorter than the base. Gonapophyses of moderate length, gradually narrowed outwardly, at apex a trifle expanded into a simple spearlike point.

Habitat: Oregon (Umatilla County).

Holotype: ♂, Langdon Lake, Blue Mountains, altitude 4990 feet, August 17, 1948 (C. P. Alexander). *Allotopotype*: ♀. *Paratopotypes*: 5 ♀♀; *paratypes*, ♂♀, Tollgate (Langdon Lake Postoffice), July 17, 1948 (M. C. Lane).

Most similar to *Limnophila* (*Phylidorea*) *flavipila* Doane and L. (*P.*) *snoqualmiensis* Alexander, differing in the details of coloration and of the male hypopygium.

GEOMETRID NOTES, A NEW GENUS AND SPECIES FROM ARIZONA.

By JOHN L. SPERRY, Riverside, California.

Oak Creek Canyon, south of Flagstaff in northern Arizona, is one of the most interesting collecting grounds in the Southwest. A narrow colorful canyon with abundant water flowing between towering cliffs, it is the happy meeting ground of the high desert and the pines. Before the last war Mrs. Sperry and the author captured three specimens of a Larentid moth which defied determination. It was sent to Washington for description but the war upset many excellent plans and Mr. Hahn W. Capps was only able to express the opinion that it represented an undescribed genus. In 1947 and 1948 we were again able to visit Oak Creek and obtained a small series of the new Larentid and after correspondence with Mr. Capps the author has decided to describe.

Herreshoffia gen. n.

(Type, *Herreshoffia gracca* sp. n.)

Palpi in both sexes moderate ($1\frac{1}{2}$ times the width of the eye) flattened, porrect heavily clothed with scales. Tongue present; front bulging, with conical scale tuft; eye, smooth, large, round. Male antennae nearly simple, every finely short ciliate; female antennae simple. Hind tibia of male not swollen and without hair pencil, with two pairs of spurs in both sexes; fore tibia unarmed.

Fovea lacking; frenulum in male, long and slender, in female, a short brush of bristles. Chaetosema, normal Hydrimenid type. Thorax untufted; abdomen of the male with small lateral scale tufts, of female with short, lateral, terminal tufts.

Forewing; 12 veined, a single areole, 3 from before the angle, 4 from the angle, 5 closer to 6 than 4, 6 from areole beyond angle, 7 and 8 connate from tip of areole, 9 from 8 near apex, 10 from 8 half way between tip of areole and 9, 11 from areole, 12 free.

Hindwing, 8 veined, 3 and 4 connate from angle, 5 nearer 6 than 4, 6 and 7 moderately stalked, 8 with cell to beyond $\frac{3}{4}$.

Forewing broad, triangular, costa curved, apex falcate, outer margin excavated between veins 1 and 3, 3 and 4, 4 and 8.

Hindwing, broad, triangular, outer margin excavated between veins 1 and 3, 3 and 4, and 4 and 6.

The shape of the wings would place this genus nearest to *Horisme* Hbn. in our North American list but the genitalia place it

between *Hammaptera* H-S. and *Camptogramma* Steph. It differs from all three of the aforementioned genera in wing shape and in having a single areole, also in the position of lines 3 and 4 on the secondaries. In the male genitalia the uncus is long, slender, needle shaped, the valvae squared at the end and the costa produced in a curved hook heavily spined at the tip, the heavily spined juxta shows the relationship in all three genera. The bursa of the female is nearest to that of *Hammaptera* the opening is heavily schlerotised, there is a short ductus bursae but there are heavily schlerotised separated plates extending well down over the bursa, signum a tiny spot on the bursa wall.

***Herreshoffia gracea* sp. n.**

Both sexes: Palpi, front, vertex antennae, legs and thorax, cartridge buff (Ridgeway color), antennae and legs flecked with fuscous. Ground color of both wings straw-white, so heavily washed with colored scales that parts of the wings seem entirely covered. Lines fuscous or of the ground color of the wing.

Primaries: Costa heavily fuscous for the first third, with white spots marking the inception of the basal and t.a. lines at one-eighth and $\frac{1}{4}$ out respectively.

These lines are double, broken, fuscous hair lines with ground color between, they swing out from the base of the costal spot at an angle of about 45 degrees, go to the cell and curve slightly back to inner margin at one-fifth and one-third out respectively. There is a tiny dark dot on the costa at one-third and suggestions of a median line subparallel to the t.a. line but fading out below the cell. At $\frac{1}{2}$ out there is an irregular, single fuscous hair line with sharp outward points at vein 12 and between veins 6 and 7, from 6 it runs roughly at right angles to the inner margin, fading out at vein 2. Halfway between this line and the t.p. there are traces of another subparallel irregular hair line of dark rose brown scales. The t.p. line is double as is the t. a. line with a white line between. The costa is broadly light, from the t.p. line to the apex and the white spot which marks the t.p. inception is lost in the ground color at costa but well marked below; this line is heavier than the others, running perpendicular to the costa to vein 7, has a sharp outward tooth between 6 and 7 and from 6 goes roughly perpendicular to the inner margin, with inward angles on the veins to inner margin at eight-tenths out. There are traces of a subparallel s.t. line, the white scales marking its position are most evident between veins 5 and 6 and between 6 and 7. There is a dark terminal line. Fringes

of ground color with occasional specklings of fuscous on the tips and dark spots at ends of veins 3, 4, 6 and 7. The whole wing is washed with yellow-brown, purple-brown, red-brown and red scales. There is a round, bright pure white spot 1 mm. in diameter in the sub-terminal area between veins 3 and 4 which is the most conspicuous marking on the forewing. The yellow-brown shading is heavy on the costal half of the basal area, across the cell, around the white spot and bordering the t.p. line outwardly above the spot. The red-brown shadings are along the inner edge of the t.p. line and in the cell outside the t.a. line. The purple-brown shading is heavy throughout the terminal area ending in a diagonal line running from 7 on the outer margin back toward the center of the wing. The wing is lightest along the inner margin, through the median area on the costa and apically near the costa. There is a tiny black discal dot at the end of the cell.

Secondaries: Costal area and inner margin from base to t.p. line, white with light speckling of darker atoms; basal area heavily speckled with purple-brown.

T.a. line continues from primaries, a solid line, obscure, curving evenly across the wing. Median line stronger than on primaries, subparallel to t.a. line. The wing beyond this line is washed with light, rosy-brown scales, blotting out the ground color. T.p. line a scalloped white hair line, the points of the scallops turning inward on the veins, curves evenly across the wing two-thirds out. There are traces of a white s.t. line from apex to tornos. There is a dark terminal line. Fringes as in primaries with the dark spots at the ends of veins 3, 4 and 6 on the wing points. Discal dot absent.

Beneath: The colors are dimmer than above and a grayer tinge predominates, the lines are indicated with about the same value as above. The bright white spot on the upper surface is dimmed. Discal spot on the primaries heavier than above, on the secondaries merely indicated.

Expanse: male, 17-18 mm., female 25-27 mm.

Holotype, female Todd's Lodge, Oak Creek Canyon, Arizona, Sept. 28, 1948, Grace H. Sperry, coll. and in the Sperry collection.

Allotype, male same locality, Oct. 3, 1948, G. H. & J. L. Sperry, coll. and in the Sperry collection.

Paratypes, 2 males, 1 female, same locality and collectors, June and September, in the U.S. National Museum. 1 male, 5 females, same locality and collectors Sept. 11 to Oct. 5, 1947 and 1948 in the British Museum and collection Sperry.

This beautiful species and the new genus of which it is the type are named in honor of my wife, Grace Herreshoff Sperry, in happy memory of thirty years lived joyously together in "sun and candle light".

Species collected or examined and genitalic work done on the Geometridae during the past year have convinced the author that there is a bit of interest and a few changes that may profitably be made in our present list, so he ventures to submit, in this paper, a few paragraphs that may be of value.

Semiothisa curvata Grote

Among our specimens taken on the Upper Santa Ana River in the San Bernardino Mts. of California, there was one beautiful albinic male, entirely white, with the brownish t.a. and t.p. lines showing clearly on the snowy ground, the costal markings mere shades and the terminal line dim on both wings. Only a trace of the t.p. line shows on the inner margin of the secondaries. Beneath it is white speckled sparingly with light brown atoms with the t.a. and t.p. lines showing dimly through the white ground color.

Semiothisa cruciata Grote

In making routine slides of *curvata* Grt. from many different parts of the West the author came upon a specimen from Frijoles Canyon, N. M. taken in July by Mr. Chester A. Thomas custodian of the Monument, which answers Grote's *cruciata* description exactly. The part of the description pertaining to the t.p. line is especially apt "outer line black, sinuous, bent outwardly on costal region" for *curvata's* t.p. line normally bends inward just below the costa. The genitalia place this specimen near or equal to *nigroalbana* Cass. and if the type specimen of *cruciata* checks this one, *cruciata* Grote is a good species with *nigroalbana* Cass. probably a synonym thereof. The author does not know where the Grote type is at present but will welcome information.

Itame nervata Gn.

Through the kindness of Mr. D. S. Fletcher of the British Museum staff the author has been able to examine a topotypical pair of this species from Brazil.

The species is not an *Itame* but was probably correctly placed by its author in the genus *Macaria*. The male antennae are ciliate and fasciculate and as near as the author can tell by the male genitalia en situ, the species belongs in the genus *Semiothisa* near *punctolineata* Pack. and has been so placed in the Sperry collection.

Dasyfidonia macdunnoughi Guedet

Mrs. Sperry and the author found a flight of this interesting insect in progress at type locality on the Mojave Desert in April and obtaining a good series the author made routine slides and discovered that this *Dasyfidonia* is a good species and not a form of *avuncularia* as originally described. The male genitalia are close but in *macdunnoughi* the whole organ is so heavily sclerotised that it is almost black and is smaller, broader and chunkier throughout. In the female however there is considerable difference. In *avuncularia* the ostium is weak, the plate in the ductus bursae moderately long and narrow and the signum is a large snowshoe shaped plaque, heavily spined at the edges. In *macdunnoughi* the ostium is stronger, the plate short and nearly square and the signum shield shaped, about one-third the size of that in *avuncularia* and very weakly spined. The insect is a day flyer, local but plentiful when it flies and the Rev. Edward Guedet's description is excellent.

Prochoerodes floridata Grote

For several years the author has been receiving from South Florida a *Prochoerodes* labelled *politia* Cramer which was smaller than it should be.

In 1947 a good series of a much larger and brighter species was received from Mrs. L. E. Forsyth of Florida City, Fla. with an inquiry as to its identity. This series checked topotypical material in the author's collection from Brazil and genitalic slides showed that it was *politia* Cramer and that we were dealing with two species from South Florida. With this in mind, through the good offices of our friend Dr. L. I. Hewes, who made inquiry at the U.S. National Museum and Mr. Hahn W. Capps who made the genitalic comparison with the type of *floridata* Grote, and to both of which gentlemen the author is deeply indebted, it was determined that our smaller species which has been placed for so many years under *politia* Cramer is in reality *floridata* Grote and that *floridata* Grote and *politia* Cramer are separate and distinct species, Dr. Hulst's remarks on the subject (1894, Ent. News V, 304) notwithstanding. There are several good differences but one will suffice.

In *politia* the aedeagus of the male has the vesica apically armed with five large curved spines. That of *floridata* is simple.

NOTES ON COLOR AND PATTERN OF EYE IN DIPTERA

By GEORGE C. STEYSKAL, Grosse Ile, Michigan.

The color and color pattern of the eye of many groups of Diptera are of value taxonomically. In many cases, however, there is no record of the character, since it disappears when the insect dries and after some time will not reappear upon relaxation.

The following notes are based upon fresh material taken from a cyanide killing bottle soon after death. All the material was captured in Michigan.

Family Stratiomyidae

Berkshiria albistylum Johnson (*Johnsonomyia aldrichi* Malloch), ♀ (Fig. 1 A). Brownish green in ground color, with green horizontal band edged with purple and purple-brown cloud in upper and lower divisions.

Eupachygaster henschawi Malloch, ♀ (Fig. 1 B). Ground color brownish green becoming brown at fore and hind margins. Anterior vertical fascia red-brown, posterior (central) fascia blue-purple, pure blue at edges. Malloch (1917: 338) states "eyes with four vertical dark stripes, one on center, deep violaceous blue, extends from upper margin to a point one fifth distant from lower margin, the others (purple) being a slender one along anterior margin, a broad one extending from lower margin almost to upper margin, between the former and the blue central stripe, and a rather broad one along posterior margin."

Neopachygaster maculicornis Hine, ♀ (Fig. 1 C). Ground color olive green with purple horizontal band running out into an extensive but weak and diffuse purple cloud in upper part of eye. Malloch (1. c.: 339) has "the upper half of eye, except the narrow posterior margin, purple, the remainder being yellowish."

Pachygaster pulcher Loew, ♀ (Fig. 1 D). Brown in ground color, with three slender purple-brown horizontal bands separated as shown by four green bands. Malloch (1. c.: 339) says only "*Pachygaster pulcher* has four slender horizontal stripes on center."

Family Aulacigasteridae

Aulacigaster leucopeza Meigen, ♂ ♀ (Fig. 1 E). Ground color brown below, purple-brown above, with four horizontal bands of bright golden green as shown.

Family Otitidae

Pseudotephritis cribellum Loew. The eye is plain brown-green with purple reflections (cf. *P. van*, below).

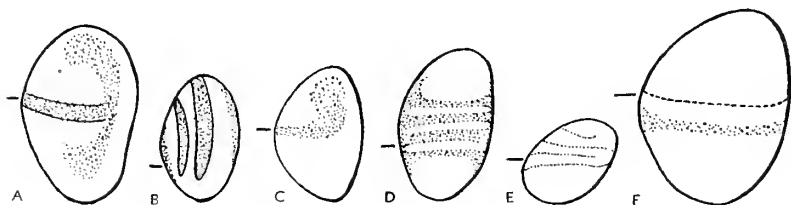
P. van Say, ♀ (Fig. 1 F). Ground color green below, crossed near middle by a purplish horizontal band, and sharply divided from a brownish-green upper part.

Pterocalla strigula Loew. Hendel (1909:27) places this species (the only one of the genus in northern North America) in *Pterocalla sensu strictu*, to which group he ascribes the character "Augen bandiert." However, several specimens taken by the writer have no discernible pattern on the eyes.

LITERATURE CITED

Hendel, F., 1909. Uebersicht der bisher bekannten Arten der Pterocallinen. Deutsche Ent. Zts. 1909, Beiheft: 1-84.

Malloch, J. R., 1917. A preliminary classification of Diptera, etc. Bull. Illinois State Lab. Nat. Hist. 12 (art. 3): 161-409, pls. 28-57.



EXPLANATION OF FIGURE I.

Eye patterns of Diptera. The dash at left indicates position of antennae. A, *Berkshiria albistylum* Juns.; B, *Eupachygaster hen-shawi* Mall.; C, *Neopachygaster maculicornis* Hine; D, *Pachygaster pulcher* Lw.; E, *Aulacigaster leucopeza* Mg.; F, *Pseudotephritis van* Say.

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EXCHANGES AND FOR SALE.

This page is limited to exchange notices and to small For Sale advertisements from members of the Society and from actual paid subscribers to the Bulletin exclusively. *Exchange notices* from members of the Society and from subscribers are limited to *three (3) lines each*, including address; beyond 3 lines, there will be a charge of \$1.00 for each 3 lines or less additional. *For Sale* ads will be charged at \$1.25 for each 3 lines or part of 3 lines. *Commercial or business* advertisements will not be carried in this page, but will go in our regular advertising pages at our regular advertising rates to *everybody*.

WANTED.—MANTID EGG CASES from West of the Mississippi River. If interested in collecting, write: Osmond P. Breland, The University of Texas, Austin, Texas.

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WANTED—Geometrid moths, for cash or exchange. John L. Sperry, 3260 Redwood Drive, Riverside, Calif.

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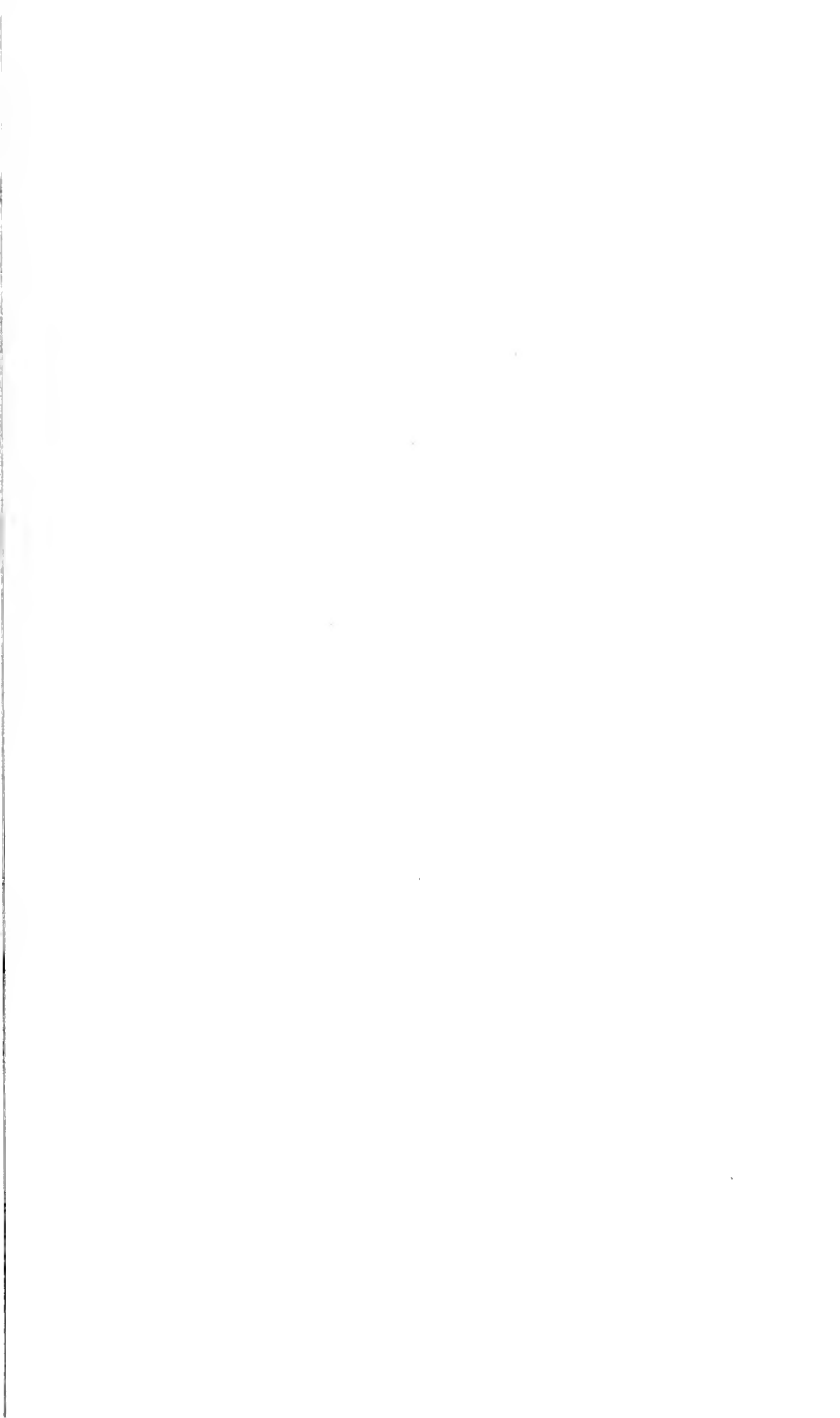
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